# The Journal of HEREDITY

DOMINANT AND RECESSIVE PIEBALDNESS IN HORSES

(SEE PAGE 65)

*Plant Patents in 1932*

*Administration of the Plant Patent Law*

*Recessive Spurlessness in the Fowl*

*"Wall-Eye" and Color Patterns in Horses*

*Eugenics and Welfare*

VOLUME 24 FEBRUARY, 1933 NUMBER 2

# The American Genetic Association

***An incorporated organization devoted to promoting a knowledge of the laws of heredity and their application to the improvement of plants, animals, and human racial stocks***


DAVID FAIRCHILD, President  Vice-President, W. E. CASTLE  Secretary, C. E. LEIGHTY

Treasurer, J. H. KEMPTON

Legal Advisors, PEELLE, OGILBY and LESH

## EDITORIAL BOARD

Managing Editor: ROBERT C. COOK

M. DEMEREC  R. R. GRAVES  L. C. DUNN

H. J. MULLER  GEORGE M. DARROW  PAUL POPENOE

Members of the Council are ex-officio members of the Editorial Board

## COUNCIL

W. E. CASTLE, Professor of Zoology, Harvard University, and Research Associate of the Carnegie Institution of Washington.

LEON J. COLE, Professor of Genetics, University of Wisconsin.

G. N. COLLINS, Botanist, U. S. Department of Agriculture, Washington, D. C.

O. F. COOK, Bionomist in Charge of Breeding Investigations, U. S. Department of Agriculture.

DAVID FAIRCHILD, Agricultural Explorer, U. S. Department of Agriculture.

HARRY V. HARLAN, Senior Agronomist in Charge of Barley Investigations, U. S. Department of Agriculture.

SAMUEL J. HOLMES, Profes or of Zoology, University of California, Berkeley, California.

C. E. LEIGHTY, Agronomist in Charge of Eastern Wheat Investigations, U. S. Department of Agriculture.

VERNON KELLOGG, Permanent Secretary, National Research Council, Washington, D. C.

J. H. KEMPTON, Bureau of Plant Industry, U. S Department of Agriculture.

E. W. SHEETS, Chief of Animal Husbandry Division, U. S. Department of Agriculture.

SEWALL WRIGHT, Professor of Zoology, University of Chicago.

## ADVISORY COMMITTEE

W. S. ANDERSON, Genetics Department, University of Kentucky, Lexington, Kentucky.

E. B. BABCOCK, Genetics Department, University of California, Berkeley, California.

E. A. BESSEY, Professor of Botany, Michigan State College, East Lansing, Michigan.

A. F. BLAKESLEE, Plant Genetist, Carnegie Institution, Cold Spring Harbor, New York.

J. K. BREITENBECHER, McGill University, Montreal, Canada.

W. E. BRYAN, Professor of Plant Breeding, University of Arizona, Tucson, Arizona.

C. B. DAVENPORT, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, L. I., New York.

J. A. DETLEFSEN, Professor of Genetics, Wistar Institute, Philadelphia, Pennsylvania.

RUSSELL W. DUCK, Professor of Animal Husbandry, Syracuse University, Syracuse, New York.

E. M. EAST, Professor of Plant Genetics, Bussey Inst. of Applied Biology, Boston, Mass.

R. A. EMERSON, Professor of Plant Breeding, Cornell University, Ithaca, New York.

C. P. GILLETTE, President, The Genetic Foundation, Fort Collins, Colorado.

C. M. GOETHE, Sacramento, California.

HARRISON R. HUNT, Professor of Zoology, Michigan State College, East Lansing.

H. S. JENNINGS, Professor of Zoology, Johns Hopkins University, Baltimore, Maryland.

D. F. JONES, Plant Breeder, Connecticut Agricultural Experiment Station, New Haven, Conn.

M. A. JULL, Senior Poultry Husbandman, U. S. Department of Agriculture, Washington, D. C.

F. B. LINFIELD, Director, Montana Experiment Station Bozeman, Montana

C. C. LITTLE, Director, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.

JAY L. LUSH, Professor in Animal Husbandry, Iowa State College, Ames, Iowa.

H. H. NEWMAN, Professor of Zoology, University of Chicago, Chicago, Ill.

T. S. PALMER, Expert in Game Conservation, U. S. Dept. of Agriculture, Washington, D. C.

JOHN H. PARKER, Professor of Agronomy, Kansas State College, Manhatten, Kansas.

MRS. CHARLES C. RUMSEY, Wheatly Hills, Westbury, Long Island.

JOHN W. SCOTT, Professor of Zoology, University of Wyoming, Laramie, Wyoming.

A. D. SHAMEL, Physiologist, U. S. Department of Agriculture, Riverside, California.

GEORGE H. SHULL, Professor of Biology, Princeton University, Princeton, New Jersey.

EDMUND W. SINNOTT, Professor of Zoology, Barnard College, Columbia University, New York City. (Representative of A. G. A. on Council of Amer. Assoc. for the Advancement of Science.)

W. W. SMITH, Professor of Animal Husbandry, Purdue University, Lafayette, Indiana.

CHARLES R. STOCKARD, Professor of Anatomy, Cornell University, New York City.

A. B. STOUT, Director of Laboratories, New York Botanical Gardens, New York City.

W. T. SWINGLE, Plant Physiologist in Charge of Breeding Investigations, U. S. Department of Agriculture, Washington, D. C.

LOU D. SWEET, Seedsman, Denver, Colorado.

W. H. TOMHAVE, American Aberdeen-Angus Breeders' Association, Chicago, Ill.

H. E. WALTER, Professor of Biology, Brown University, Providence, Rhode Island.

H. J. WEBBER, Prof. Subtropical Hort., Citrus Experiment Station. Riverside, California.

E. N. WENTWORTH, Armour's Bureau of Agr'l Research and Economics, Chicago, Illinois.

P. W. WHITING, Department of Biology, University of Pittsburgh, Pittsburgh, Pa.



The JOURNAL OF HEREDITY is published monthly by the AMERICAN GENETIC ASSOCIATION at 1918-32 Harford Avenue, Baltimore, Md., and Victor Building, Washington, D. C. Address all communications regarding editorial matters to Room 306, Victor Building, Washington, D. C. Communications regarding the business management of The JOURNAL OF HEREDITY may be addressed to the publication office, 1918-32 Harford Avenue, Baltimore, Md., or to the Victor Building, Washington, D. C. Entered as second-class matter February 24, 1923, at the postoffice at Baltimore, Maryland. Acceptance for mailing at the special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 20, 1918.


Contents copyrighted 1932 by the American Genetic Association. Unauthorized reproduction of material from THE JOURNAL not permitted. The title "Journal of Heredity" is registered as a trade-mark in the U. S. Patent Office.


$3.50 a Year, 35c the Copy. Prices of back numbers on application.

*The*

# Journal of Heredity

Vol. XXIV FEBRUARY, 1933 No. 2

## CONTENTS

A "Reverse" Mutation in the Apple
*By C. E. Myers* ..... *Frontispiece*

More Plant Patents
*By Robert C. Cook* ..... 49

Plant Patent Queries
*By Robert Starr Allyn* ..... 55

Plant Patents Issued in 1932 ..... 59

The "Pied" and "Splashed White" Patterns in Horses and Ponies
*By V. M. Klemola* ..... 65

Spurlessness of the White Leghorn
*By A. W. Kozelka* ..... 71

**Reviews and Notes**

Eugenics and Race Progress ..... 64

Hybrid Corn Varieties Produce Highest Yields ..... 64

Books Received ..... 69

Probability Tables for Mendelian Ratios ..... 78

**Are *You* A Taster?**

**TRY A SMALL BIT OF THE TREATED PAPER**

***(It is entirely Harmless!)***

TO SOME it will be tasteless to others it may be bitter, sour, sweet, or salty. These differences in taste reaction are inherited, inability to taste the substance apparently being transmitted as a Mendelian character. [A. F. Blakeslee and A. E. Fox, *Journal of Heredity*, March 1932 and *Proc. Nat. Acad. Sci.* January 1932.]

The white paper under this cover is treated with P.T.C. (phenyl-thio-carbamide). On the average 7 people out of 10 on chewing up a bit of the treated paper will detect a definite taste. Others will taste nothing. These peculiarities in taste discrimination are inherited.

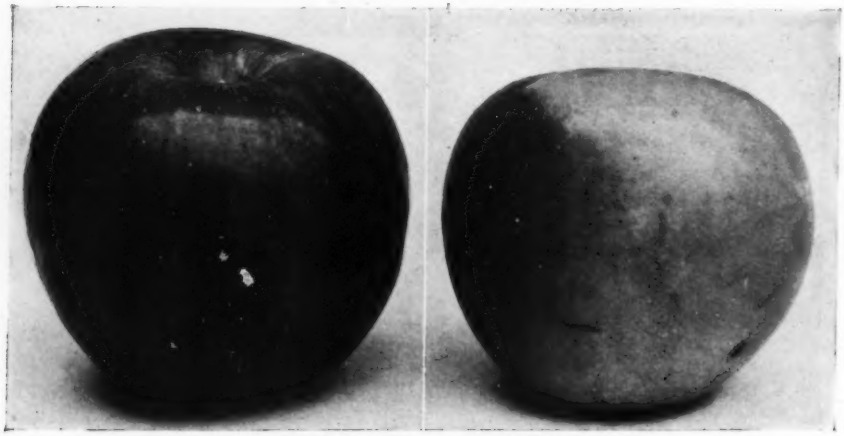
# LEAFLETS TO DEMONSTRATE TASTE-BLINDNESS

A most successful "interest arouser" for lectures and classes. Many thousand samples of paper treated with P.T.C. have been distributed in the past nine months. The reaction arouses immediate interest. These leaflets, size 3⅜" by 5½", are available in quantities for those who wish to use them for classroom or lecture purposes. On the back is printed an outline 4-generation pedigree chart. Sample on request. Prices: 10 for 25c; 50 for $1.00. 7" by 10" size, containing larger chart and more extended discussion of sense differences, 5 for 25c; 30 for $1.00.

**AMERICAN GENETIC ASSOCIATION**

**VICTOR BUILDING WASHINGTON, D. C.**

# A "REVERSE" MUTATION IN THE APPLE



**FROM RED TO GREEN**
Frontispiece

READERS of the JOURNAL will recall that in its pages are recorded many instances of a variety sporting from a light to a darker color as in the case of the Starking, Red Rome, Stay-Ma-Red, and others. In Shamel and Pomeroy's résumé of recorded bud mutations in the apple, there were 143 cases of mutation from a lighter to a darker color and only three cases of mutation from red to green. Possibly this may be due in part to the more striking contrast of a green-to-red mutation, but in any event the reports of the occurrence of red-to-green mutations are rare enough to deserve recording. A case of such a "reverse mutation" in which the tree as a whole produces apples which are normal and well colored, while one branch produces only poorly colored specimens has recently come to the writer's attention. This tree is in the orchard of A. C. Hess & Sons, Mont Alto, Pennsylvania. I have been informed that the tree is about 21 years old. This particular branch which produces these poorly colored apples is near the center of the tree while all about them are well colored specimens. The limb is not large and the owners have assured me it is not the result of a graft. Since it does not appear to possess characteristics that render it especially desirable, the mutation will hardly be perpetuated as a new variety.

C. E. MYERS.

*Dept. of Plant Breeding,*
*Pennsylvania State College.*

# OTHER PLANT PATENTS

OVER a year ago we reported in the JOURNAL OF HEREDITY the issuance of the first plant patent. This was followed by a discussion of the three succeeding plant patents. These articles called attention to some of the interesting and possibly conflicting questions of horticulture and of law raised by the new statute. Since that time, to January 1, 1933, 51 plant patents have been issued. Flowers, and more especially roses, hold the center of the plant patent field. The groups to which the patented varieties belong are as follows:

| *Flowers* | | *Fruits* | |
|---|---|---|---|
| Roses | 20 | Plums | 5 |
| Carnations | 5 | Peaches | 4 |
| Freesias | 4 | Cherries | 3 |
| Dahlias | 2 | Strawberries | 2 |
| | | Grapes | 1 |

| *Miscellaneous* | |
|---|---|
| Dewberry | 1 |
| Bramble | 1 |
| Pecan | 1 |
| Mushroom | 1 |
| Barberry | 1 |

The purpose of the Plant Patent Law is unquestionably worthy: To give the breeder of new varieties of plants a more nearly adequate recompense for the often arduous, persistent, and ingenious efforts he must put forth in originating a new form. Whether the plant patent law as at present enacted and administered will bring about this highly desired consummation remains to be seen. As we often learn, there are many slips between the legislative cup and the administrative lip. Thus the administration of the law has been watched by friends of the plant breeder with considerable interest and with some trepidation. As the months have passed it has become increasingly evident that the ultimate effect of the plant patent law in the light of its administration to date is very problematical. It is felt that, precious as some of the patents are as examples of the abstruse and of the absurd, it is nevertheless more important to try to influence the administration of the law in a constructive direction than to make Roman holidays of the mistakes. With this in mind a letter and a detailed statement was prepared calling attention to some of the more flagrant absurdities, trivialities and downright misstatements of fact in the specifications of some of the plant patents so far issued. This was addressed to the Commissioner of Patents on November 18, 1932. The accompanying letter called attention to five questions on which the opinion of the Patent Office was desired. The text of the letter and the statement are as follows:

November 18, 1932.

*The Honorable Commissioner of Patents,*
*Department of Commerce,*
*Washington, D. C.*

*Sir:*

The membership of this Association represents one of the largest groups interested in the creation of new varieties of plants, in the United States. Many of our members have in the past produced new varieties of outstanding importance, and others will doubtless apply to the Patent Office for letters patent on new varieties of asexually propagated plants. For this reason we have an especial interest in the administration of this law. It is realized that the details of handling plant patent applications must be largely experimental at first. Some principles involved in plant patents are new to patent law, and on a recognition of the importance of these principles depends the ultimate success of this legislation.

There is a serious danger that unless these principles are applied in the administration of the law, the experiment of patenting varieties of plants will be apparently a failure, and the plan will be condemned as unworkable. It is quite easy when embarking on a new field of activity to run into unappreciated difficulties. These, if recognized, may not be insoluble. If passed over and ignored, they may make the new law unworkable and even absurd in practice. We feel that the experiment is sufficiently important so that it would be a disaster to have such a contingency arise in the administration of this law.

In connection with several of the patents issued to date, a number of points have been noted which seem to us, as viewed from the

breeder's point of view, to have been handled in a way that tends to cast discredit on the Plant Patent Law. We are anxious to place before our members a statement with regard to the present status of the law, and we should greatly appreciate the views of the Patent Office on the following five points:

1. Plant Patent 11 is assigned to "joint inventors." One of the "inventors" discovered a bud-mutation which was propagated by "the second named joint inventor." Routine propagation is by no stretch of the imagination an inventive process. Is not this a violation of the principle that joint inventors must each have contributed something more than routine processes and skill to the creation of a patentable invention?

2. Inclusion in Plant Patent specifications of irrelevant, absurd, and even of false, statements. Specific instances are cited below from the specifications of Plant Patents 19 and 21.

3. Form and content of Plant Patent specifications are distinctly different from those of mechanical or chemical patents. It is a matter of some practical importance to give serious consideration to determining what is to be included in a plant patent specification and for what purpose. In the last analysis a plant patent must refer back to an actual living plant; no drawings and descriptions can take the place of this. It is urged that serious consideration should be given to this point.

4. On what basis are people who discover bud mutations and other aberrant forms of plants entitled to a patent?

5. On what basis is it determined that a person who wishes to purchase a copy of a plant patent bearing a colored drawing shall be allowed to do so? The present restrictions on the sale of copies of plant patents is unfair to plant breeders, and should be modified.

On the following pages these various points are discussed in some detail. It seems to us that the ultimate success or failure of the plant patent law hinges on the way in which some or all of these points are construed by the Patent Office. They are therefore a matter of real importance in the working out of this law. We should greatly appreciate your views on these general questions, and your interpretations and comments on the specific examples cited in the attached statement.

Very respectfully yours,

ROBERT C. COOK,
Managing Editor.

## The Plant Patent Law From the Breeder's Point of View

Included with the letter was the following statement:

The following comments and suggestions regarding various phases of the Plant Patent Law view the matter from the point of view of the biologist and horticulturist. They are presented with the hope that such a viewpoint may be helpful during the present necessarily experimental phase in the working out of the Plant Patent Law. It is recognized that for this reason some of the suggestions may run directly counter to present practice with regard to patents for mechanical and chemical inventions. Even should this be the case, it might not necessarily be a conclusive answer to the points which are raised. Plants by their very nature are so different from other forms of patentable objects and ideas that drastic modification of current procedure may be necessary to arrive at a satisfactory technique of handling plant patents.

---

### 1. Joint Inventions

From the specification of Plant Patent 11:

"Our invention related to improvements in pinkish-red, fragrant, semi-double, hybrid tea roses. The object is to provide a rose of this type mentioned having a deeper and more appealing color, heavier and darker foilage, a better producer and other superior qualities as compared with somewhat similar varieties.

"This new rose was first discovered as a sport by the first named of the joint inventors, during the year 1929. The second named joint inventor fostered and developed the plant, studied its characteristics and asexually reproduced it by budding.

"The accompanying illustrations show in full color and in approximately natural size two partly opened buds and a fully opened flower of our new variety."

Joint invention takes place when two individuals co-operate in the production of a new idea and in the steps that result in its physical embodiment as a practical and useful object. The first paragraph of the above quotation tells us that the object is to provide a rose having certain desirable characteristics. The "first inventor" then proceeds to "discover," a sport embodying these characteristics. Now the "second named of the joint inventors" appears in the picture; he "fostered and developed the plant, studied its characteristics and asexually reproduced it by budding." Invention is distinctly and definitely not something that anyone "skilled in the art" would do. A mechanic who constructs a new machine for an inventor does not by that act become a joint inventor. "Fostering and developing a plant," obviously has nothing to do with the production nor with the discovery of the new form;—nor would studying its characteristics. Asexual reproduction of roses is carried on in hundreds of nurseries the world over. To a plant breeder this does not appear to be a

novel procedure; it can hardly be considered to constitute invention.

The granting of a patent to the discoverer of a form when he has taken no part in its production (bud mutation) is considered by some competent authorities to be distinctly contrary to the intent of the present statute, because of the absence of any inventive faculty in merely finding a fortuitious mutation. That the Patent Office has been willing to include as an "inventor" a person who has not even *gone out and looked for the new form* is altogether astonishing. This procedure is likely to produce the impression that the Patent Office is proceeding in the administration of this law without considering the biological and horticultural principles involved in plant breeding and plant propagation.

---

**2. Irrelevant and Absurd Statements**

From Specification of Plant Patent 19:

"To produce my new dahlia I adopt the following procedure although it is to be understood that any other suitable methods may be used. I first select a fine specimen of the well known variety of dahlia 'Jersey's Beauty' which is classed as a Formal Decorative and is generally spoken of as Eosine pink in color, as the pollen bearer. As the development of this selected blossom or flower is nearing full maturity, I select a fine specimen of the well known variety of dahlia 'Mrs. I. de Ver Warner' which is classed as Formal Decorative and which is Cattleya rose or mauve pink in color, on the bush, being careful to select a blossom which can be kept free from ants and insects. When the yellow pollen dust on the Jersey's Beauty is dry and siftable, it is taken and with the aid of a piece of cotton on the end of a small stick, it is placed in the center of the blossom selected to ripen into seed. After the blossom or flower has been hand fertilized it is kept free from ants and insects. When the flower dies all the petals are removed and the pod is allowed to dry and turn brownish in color. Caution must be exercised not to permit the pod to become too dry. The pod is then cut and the seeds removed. The seeds are then dried and packed away until spring.

"These seeds are used to develop seedlings which produce plants which come to full maturity in one season. From seedlings produced by such a crossing as I have described herein I invented and discovered my new variety of dahlia."

Patent specifications are a form of literature rather given to reiterative verbosity. Nevertheless one would never describe in detail the process of screwing a bolt on a nut in a mechanical patent nor of splicing a wire in an electrical patent. Nearly 200 years after Koelreuter, such minute details regarding the process of hybridization are irrelevant and unnecessary, when three lines would do as well: "to produce my new dahlia, I crossed two well known varieties 'Jersey's Beauty' and 'Mrs. I. de Ver Warner.' From among the seedlings of such a cross, I selected the herein described variety." Of course if some novel technique were involved the detailed description might very well be justified.

Even more surprising is the discovery of dioecism in roses, as recounted in Plant Patent 21 (italics ours):

"My new rose was produced from a rose seedling, of an unnamed variety, which I employed as the male member, and a rose of the butterfly variety, which I employed as the female member. From the stamens of the male member pollen was taken and *injected* into the stigma of the female member. As a result of this fecundation fertile seeds were formed in the *stigmas* of the female member, which seed were sown in properly prepared soil, which seeds germinated and brought forth plants which produced *both male and female roses.* When the said *male and female* roses were fully open in bloom, that is, when they were ripe, then the pollen from the stamens of the *male members* was at the proper time placed in the stigmas of the *female members,* thereby crossing the two, therefore after germination they produced my new rose, which is therefore a hybrid tea rose. My new rose was then asexually reproduced and carefully propagated, and it has been further greatly improved by intercrossing and otherwise, whereby its new and desirable characteristics have been fixed, whereby it can now be cultivated and grown without danger of its reverting."

To a plant breeder the whole paragraph seems a jumble of meaningless words. One can say with little danger of contradiction that the statement was prepared by a person who had never hybridized roses. The use of the word "injected" is almost conclusive evidence on this point: the "injection" of pollen into the stigma being absurd. (See the correct description of the technique in plant patent 19 above.) We may also briefly mention in addition: (1) Roses are almost universally perfect-flowered; that is, there are no "male" and "female" roses; each flower is *both* male and female. In order to make a controlled cross between varieties of roses the male elements (stamens) must be removed manually. The discovery of such forms of roses (males and female) would be a scientific find of great interest. (2) A number of patents have almost the identical words:—"My new (rose) was thus asexually reproduced and carefully propagated and it has been further greatly improved by intercrossing and otherwise." "Further intercrossing" is, to a plant breeder, meaningless

in this connection. It may make little difference whether propagation be "careful" or careless, as far as the tendency to revert is concerned, but "further intercrossing" is the last thing that a rose breeder would do with a form which he intended to maintain. Intercrossing means sexual reproduction. Other new forms might appear as a result of intercrossing, but the original one would almost certainly be lost. What is claimed under the law is that the form is asexually reproduced. The Patent Office would be entirely justified in refusing to grant a patent embodying such absurdities. The repeated inclusion of meaningless stock phrases, copied from patent to patent, is to be deplored. They serve no useful purpose and by the obviousness of their source* they discredit the whole procedure.

### 3. Form of Patent Specifications

Examples could be multiplied. The essential point is that the purpose of the specification of a plant patent does not seem to be clearly comprehended. The purpose of the specification of a mechanical or a chemical patent is to enable anyone to manufacture the machine or the compound disclosed. In most cases, there is no possibility of a plant breeder being able to describe the process of making a new form that can be relied upon to make the same form again. The breeder himself could probably not do this. It is not essential, because as long as a single plant of the new variety exists it can be multiplied almost indefinitely. Thus the purpose of the specification of a plant patent would appear to be rather to give information about the parentage of the new form, and detailed information about the characteristics of the new form which would make its identification possible. For purposes of identification the colored drawings may prove to be of very questionable value (see below).

In the patents so far issued little progress has been made in developing a form of specification adapted and suited for description of new plant varieties. In the case of mutations and chance seedlings, perhaps little can be said. Exact statements regarding the botanical characters rather than generalities would seem the desideratum, with exact information regarding the location of the parent plant bearing these mutant limbs or parts. As long as they are in existence such parent plants are the point of reference for variety determination.

Establishing the source of a new variety by such means is standard practice among reputable horticulturists. In some instances an attempt is made in the specifications to establish the fact that the discoverer of a bud mutation has appreciated the need for a specific mutation of this form and eagerly sought and anticipated its appearance. To the plant breeder, the transparent absurdity of repeatedly making such an allegation is obvious.

In the case of patents for hybrids of known parentage it would seem to be worth while to enter in the record as much specific evidence as is available about the hybrid. If the date when the parent plants were crossed is known, it should become a matter of record. As the plant patent law develops, one can foresee the time when professional plant breeders will work in pairs, and the cards attached to the plants will bear not only the date of various operations but a formal witnessing of the act of placing pollen on stigma, etc. Some years ago, Dr. David Fairchild described in the *Journal of Heredity* the making of a plant hybrid,† suggesting methods of establishing how and when a hybrid had been produced. Such a record as that presented by Fairchild of the genesis of his Actinidia hybrid would be of the utmost importance in establishing the priority of a new plant form developed by hybridization.

As in the case of varieties arising by mutation, the location of type specimens of selections and hybrids is important. Thus in the case of the Stark patents of Burbank's hybrids there must be somewhere in the Stark Nurseries a tree of the new variety actually growing. The location in a specified nursery or orchard, of a tree or trees of the new variety, is an extremely important matter that might well take the place of some of the "filling" now found in most of the plant patent specifications. It is an addition that would have no little importance in variety determination. In the second paragraph of the specification of Plant Patent 25, it is set forth by the patentee that—"I still have the parent plant growing on my grounds at Cromwell, Connecticut, producing typical Talisman roses on one-half of the plant and this new yellow variety on the other half." This is an important step in the right direction, which if not mandatory in plant patent specifications is nevertheless to be encouraged.

While it is true that in some instances the type plants might die before the expiration of the patent period, in most instances they would not, and their importance might be very great in the case of litigation regarding priority of invention of a new variety. While the inclusion of the location of such type plants is not mentioned in the present law, there would appear to be no legal objection to it, and it would be very important in making the law more specific and more workable. It is necessary to recognize the fact that distinctions between varieties of

* The specification of plant patent 2 has almost identical phraseology—"My new rose was then asexually reproduced and propagated, and it has also been improved by inter-crossing and otherwise . . .".

† Fairchild, David. "The Fascination of Making a Plant Hybrid." *Journal of Heredity* 18:49-61. 1927.

plants cannot always be made either by drawings or by descriptions. In the last analysis in almost all cases reference will have to be made to an actual living plant of the variety.

**4. What Bud Mutations are Patentable?**

The issuance of patents for new varieties arising as bud mutations represents rather an innovation in patent law. Bud mutations are entirely fortuitous events over which the discoverer has no control. About a third of the patents so far issued have been for such bud mutations. Has any clearly defined principle been enunciated to determine under what circumstances the discoverer of a bud mutation is entitled to a patent? Can anyone claim a patent on a bud mutation of a cultivated plant and are patents on bud mutations of wild plants considered not allowable? Since we understand that some applications for patents on bud mutations have been rejected, a working principle covering this point must have been adopted. In fairness to plant breeders we should appreciate a statement setting forth the basis on which such cases are decided. The same principles would appear to govern claims for patents on chance seedlings found growing wild. An instance of such a seedling is that which produced the York Imperial apple. This tree was found growing in a hedgerow. It was not on the land of the nurseryman who propagated it. In such a situation who would be entitled to a patent?

**5. Policy of Distribution of Patents**

Copies of the plant patents which include a colored drawing are not easy to obtain. The cost of making the color plates is considerable, and the price prescribed by law for a printed copy of a patent is ten cents. The patent authorities have taken the view that these patents are too valuable to be disposed of casually, and an applicant for a copy must "show cause" why he should be sold one. This situation is somewhat unprecedented, and distinctly unfair to plant breeders. In the first place, they will be hindered in obtaining copies of the patents in the field in which they are interested. Since only a limited number of copies are available these will mostly find their way into hands of patent attorneys interested in plant patent cases. It would appear to be perfectly fair to charge as much for the plant patents as their preparation warrants, so that their distribution would not constitute too great a drain on the Federal Treasury, but it does not seem justifiable to limit the sale of these patents as is being done at present. It is possible, for those who at present are not allowed to buy copies of these patents, to obtain photostat copies of them? These would give the available printed information, and some inkling of form, etc. Until copies of plant patents are generally available to interested parties the situation can hardly be considered satisfactory from the plant breeder's point of view.

---

This statement and the accompanying letter were forwarded to the Commissioner of Patents over four months ago; neither an acknowledgement nor a reply has been received. On February 23 proof of this article was sent to the Commissioner, but this has neither been acknowledged nor commented on.

At present the Patent Office has neither the equipment nor the personnel to administer the Plant Patent law. The patents issued to date may be cited as proof. The Patent Office is divided into some 65 "divisions." These range from a telegraphy division, a label pasting and paper hanging division, a carbon chemistry division, a textile division, a medical division, etc. The examiners in the chemical division are chemists. Those in the radio division are grounded in the fundamentals of physics and electricity. The examiners of medical patents assumedly know the formula for Lydia Pinkham's Pink Pills when they see it. In the case of plant patents it is different. Plant patents, representing as they do a rather radical departure from other branches of patent activity, are nevertheless not granted the dignity of a separate division. They are in Division I—"Closure Operators; Fences; Gates; Tillage; Handling Implements."* The Chief Examiner of this division with one assistant handle the plant patents along with the 1933 ideas on fancy gate openers, farther and wider manure spreaders, and new ways of grafting plants. The Chief Examiner has served the Patent Office many years, and what is said here is in no way a reflection on him. The reflection is rather on placing on his shoulders a burden which he should not be expected to bear, for he is a mechanical engineer. He is frankly and completely innocent of even the rudiments of botanical or horticultural knowledge. In the absence of this it is axiomatic that absurdities will continue.

The Department of Agriculture has

**Gazette* of the U. S. Patent Office.

been made by Executive order a source of technical information, when such information is requested by the Commissioner of Patents. According to the identical terms of the Plant Patent Act of May 23, 1930, and of President Hoover's executive order of October 17, 1930, the Secretary of Agriculture is directed to do three things:* "(1) to furnish the Commissioner of Patents such available information of the Department of Agriculture, (2) to conduct through the appropriate bureau or division of the department such research upon special problems, or (3) to detail to the Commissioner of Patents such officers and employees of the department, as the Commissioner may request for the purpose of carrying said act into effect."

The Commissioner has not thus far made available to his Office any expert botanical knowledge through transfer of personnel. The wording of the act makes it plain that the other functions of the Department of Agriculture are limited to furnishing information requested by the Commissioner. It is clear from the text of some of the patents issued to date that information and opinions regarding the botanical and horticultural content of the patent specifications has not been conceived by the Commissioner to be within the province of the experts of the Department of Agriculture. It is a recognized function of the Patent Office to scrutinize patent specifications carefully and to demand of inventors and their agents reasonable occuracy and relevancy of content. This has obviously not been done in the case of plant patents. The failure to apply even routine care in this matter is a serious reflection on the Patent Office. These matters are also of direct importance to those who obtain plant patents *because absurd or false statements in a patent specification can never redound to the advantage of the patentee and may impair the validity of the patent.*

The person directly in charge of the administration of the plant patent law should possess an unusual combination of qualifications. He must have a clear understanding of horticultural problems and technique and an adequate grounding in patent law, so that he can ask intelligent questions of both legal experts and botanists. Without this rare combination of interest and information the likelihood of a really effective administration of the law is extremely remote. The first step in this direction would appear to be the creation of a special Plant Variety Division of the Patent Office under the direction of a chief examiner with the qualifications we have indicated. The division of responsibility and authority is fatal to efficient administration.

On the following pages is an article expressing a patent attorney's views on certain features of the law. He sees the problem from a distinctly different angle than the plant breeder, and the outlook is very valuable to those interested in the law. As far as we have been able to discover, very few patent attorneys have gone far enough into the question of plant patents to be much better posted in the matter than is the Patent Office itself. Following Mr. Allyn's remarks is a list of the patentees and the claims of the patents issued to January 1, 1933.

ROBERT COOK.

* The full text of President Hoover's Proclamation as of October 17, 1930, is as follows: "I, Herbert Hoover, President of the United States of America, Under the authority conferred upon me by act of May 23, 1930 (Public No. 245), entitled "An act to provide for plant patents," and by virtue of all other powers vested in me relating thereto, do hereby direct the Secretary of Agriculture: (1) to furnish the Commissioner of Patents such available information of the Department of Agriculture, or (2) to conduct through the appropriate bureau or division of the department such research upon special problems, or (3) to detail to the Commissioner of Patents such officers and employees of the department, as the Commissioner may request for the purposes of carrying said act into effect."

Section 4 of section 4892 of the Revised Statutes reads: "Sec. 4. The President may by executive order direct the Secretary of Agriculture (1) to furnish the Commissioner of Patents, such available information * * * etc.," as above.

# PLANT PATENT QUERIES

## A Patent Attorney's Views on the Law*

ROBERT STARR ALLYN
*41 Park Row, New York City*

WHAT is a plant"?

"A vegetable, an organized living being, generally without feeling and voluntary motion, and having, when complete, a root, stem and leaves."

Is a rose blossom or a peach, a berry or a mushroom or a nut—a "plant" within the law?

Does a United States "Plant" Patent give its owner the right to exclude others from importing or dealing in flowers, fruits or nuts, and if not—why not? Does the patent cover both plant and fruit or flower—or is a Plant Patent like a machine patent limited to the product and must we have an amendment to the Act to cover the product of the new Plant?

It certainly does not exclude others from reproducing by seed if they can, because the protection is limited to asexually reproduced plants.

If I own a piece of land and you plant a nut which produces an unusual tree and a third party finds a new nut on the tree—who is the inventor, you or I or the third party? If so, why? And if not, why not? Are we joint inventors?

Is the grant of a patent on a tree applied for after two years' sale of the fruit barred? If the plant was sold before the passage of the Plant Act is it patentable?

If I produce a new flower by crossing two varieties and you duplicate it by the usual methods, are we joint inventors? If you modify a plant by treating the buds or other parts by X-Ray or otherwise and I reproduce it asexually, who is the inventor?

If you produce a new plant and then patent it and subsequently your supply is destroyed or if you refuse to supply such plants what becomes of your patent? How is the public benefited by the patent? Has the progress of the arts and sciences been promoted? †

If the new fruit or flower was on the market prior to May 23, 1930 can a valid patent be granted for the "plant"?

Some of these queries sound rather foolish but most of them will have to be answered sooner or later.

Of course, initially the Commissioner of Patents is responsible for the administration of the law and his rules must be satisfactory to the Secretary of Commerce. The President has directed the Secretary of Agriculture to furnish all necessary technical assistance. The Townsend-Purnell Plant Patent Act was passed by Congress and approved by the President on May 23, 1930.

The earliest filing date of the issued cases is that of Patent No. 2, issued October 13, 1931, filed July 1, 1930 by Frank Spanbauer, of North Kansas City, Mo. This claims "a rose—predominately distinguished by petals which are scarlet crimson in color, semi-double in appearance and in which the outer petals are inclined to be cordate in shape." This is described as developed by crossing a General Jacqueminot with a Richmond. It will be noted, however, that the claim purports to cover the flower and not the plant! Query—can we safely reproduce the plant or can the owner enjoin a florist who sells cut flowers in New York

* Republished by permission with some abridgement and with a few additions by the author, from the *Journal* of the Patent Office Society.

† Patent law is based on Article 1, Section 8, U. S. Constitution: "The Congress shall have power . . . to promote the Progress of Science and useful Arts, by securing for limited times to Authors and Inventors the exclusive right to their respective writings and discoveries."

which were grown in New Jersey by some one else?

The first patent to be granted August 18th, 1931 on an application of Henry F. Bosenberg, has had considerable publicity. This claims a climbing rose, characterized by its everblooming habit. It is said to be an improvement on the Dr. Van Fleet, to which the new plant is identical as respects color and form of flower, general climbing qualities, foliage and hardiness. The supposed novelty is an "everblooming habit." "The same everblooming habits may be attained by breeding this new quality into other varieties of climbing roses." How? Not a single word can be found in the patent as to how this quality was attained or how it could be attained. Is this valid? Why was such a statement allowed in the patent? It does not seem to us that the patent complies with Section 4888 of the Revised Statutes. Of course, Section 2 of the Act provides, "No plant patent shall be declared invalid on the ground of non-compliance with this Section (4888) if the description is made as complete as is reasonably possible." This is quite elastic, but the patent seems to have exceeded the elastic limit.

Patent No. 10 also claims exactly the same characteristic of the everblooming habit, but here we find at least an effort to tell how to produce it—i. e., crossing Paul's Scarlet Climber with Gruss an Teplitz. This patent shows scarlet blossoms. Why was this application not placed in interference with the application for Patent No. 1? Of course the variety is different—but the claim is the same. Both parties are claiming the same invention which should require an interference to determine who was the first inventor.

Patent No. 28 also claims a climbing rose of everblooming habit. This rose is, however, yellow, obviously not to be confused with the scarlet rose of No. 10.

Roses said to be protected by Patents No. 1 and No. 10 are already being advertised in current newspapers.

Many of the Plant Patents purport to be for "sports" found by the applicant. Again we fail to see how these patents comply with the law. The law as originally proposed provided for patents "to anyone who finding an already existing plant reproduced the same asexually." The Commissioner of Patents in his memo of March 8, 1930 to the Secretary of Commerce plainly indicated that this was of doubtful validity under Article 1, Section 8 of the Constitution. The Bill was then amended and the report of the Committee on Patents said, "The Bill does not provide for patents upon varieties of plants newly found by plant explorers or others growing in an uncultivated or wild state." Obviously the asexual reproduction of a sport does not require invention.

The history of the Plant Act plainly shows that it was not intended to protect mere "finds." A sport not created by the act of the inventor is clearly not his invention and he can not make an invention out of it by merely asexually reproducing it by the usual methods. The reproduction does not make a new plant. This is obvious from the fact that in several cases the patentee clearly admits that the original was a sport of a certain variety of plant which was proved to be permanently new by the usual act of asexual reproduction. He has not produced something new from the sport, but has duplicated nature's sport and claims that sport. Patent No. 25 is a good example of this type of patent. A newspaper write-up of this beautiful rose appeared in The Hartford *Courant*, of January 3, 1932, indicating that the rose was one of nature's freaks or sports. This is the day of "sport" model cars—why not "sport" model patents?

The crossing of two unnamed seedlings and the crossing of an unnamed seedling with the pollen parent Souvenir de Claudius Pernet may sound as if the applicant had tried to comply with Section 4888, but we must confess to complete inability to profit by such a

description. And yet these histories are to be found in issued patents.*

A failure to give any history of the development may constitute a powerful background for the defense of an independent inventor. Doubtless this feature must have been considered in drafting the application. Either the inventor had no information or preferred to leave the public in the dark, as would appear to be sometimes done by foreign solicitors.

Several patents have been granted for alleged inventions by the late Luther Burbank, who died in 1926. All of these carefully describe the characteristic of the fruit and the trees and carefully claim the trees as distinguished from the fruit but do not even suggest how they were produced. One rather naïvely claims, "The plum tree herein described, characterized by the early ripening period of the fruit, as shown"! Strange to say not only is the early ripening period not *"shown"*—but it is not even mentioned in the specification!

The Pecan Patent No. 47 claims the nut, not the tree. While this is not described as a "sport" it was found "on my father's farm," says the applicant. This was originally rejected as a "mere find." The case, however, was later allowed after the unique argument that "the sudden death of the father was the deciding factor in causing the application to be made out as a single name application." The father planted the nuts, the son observed and reproduced the new variety!

Patent No. 4 was the first utilitarian patent—on a Thornless Dewberry or "Youngberry." "The sport was discovered growing in a ten acre field of Young dewberries with the parent vines heavily covered with thorns and the discovery was made in the summer of 1928 on plant 1 and row 27 in a plot of ground known as Hayden field that is located about one mile west of Chico, California." We suppose the applicants did the best they could to comply with Section 4888, but why did they not tell us what day it was and the weather and how it took two people to discover what already existed? It doubtless is a very useful plant, but does it comply with the law? And again does the patent cover the fruit or only the plant? The fruit is apparently old.

It would appear that the Patent Office has arbitrarily determined that the inventor of a new and distinct variety of Plant can only have a single claim as in Design Patents. The writer has never felt that the rule was fair in Design cases. It is especially harsh in Plant cases. Again Patents Nos. 1 and 10 are horrible examples. As pointed out, the claims of these two patents are substantially identical. If No. 1 was entitled to the claim as drawn it would appear that he should also be entitled to a claim for the modified Dr. Van Fleet, a pink rose. Then the owner of Patent No. 10 should be entitled to a sub-claim limited to the scarlet everblooming climber although his broad claim might be invalid in view of prior Patent No. 1. In the latter case No. 10 might disclaim his broad claim and still have protection on the scarlet climber. On the other hand, of course, No. 10 with the present broad claim might file a "trick" disclaimer except to the scarlet variety. The writer, however, does not approve trick disclaimers and agrees with Judge Tuttle in *Fruehauf vs. Highway Trailer*, 54 F. 2nd, 691 that they are invalid. Some day I hope that the Patent Office will decline to accept a trick disclaimer on the ground that it is not a disclaimer within the statute and force a court consideration of a mandamus.

---

* Earlier articles in this Journal have called attention to the impossibility of "disclosing" the process of producing a new form. Even the original inventor could rarely produce it again. This is one of the ways in which a plant patent differs fundamentally from a mechanical or chemical patent. EDITOR.

This may be true but the law requires a description to be made as complete as is reasonably possible--otherwise the patent is probably invalid. ALLYN.

While the horticulturist may have rather definite ideas as to what constitutes an "everblooming habit" we suspect that the legalist will not have any difficulty in developing a serious argument in defense of a charge of infringement.

Then, too, we shall have nice questions for the experts. "A better flavor" may be an adequate characteristic for a patent, but we wonder who can describe it? Pray tell me, what does an onion taste like? Please describe the odor of the rose which you purchased on the 15th day of June 1932?

The possibilities of humor as to the "flowers that bloom in the spring" etc. are quite unlimited. Who will say that a patent may not be granted for a bread and milk plant produced by crossing a bread fruit tree with a milkweed by the dark of the moon?

An interesting question of infringement may also arise as to two cherry tree patents. The fruit of Patent No. 29 ripens from ten days to two weeks *later* than the true Montmorency and No. 30 ripens ten days to two weeks *earlier* than the Montmorency. As the ripening period, of course, depends upon the soil and climate it would appear necessary to grow a true Montmorency alongside of the alleged infringement in order to make the rather nice comparison.*

Many of the flowers are extraordinarily beautiful and some of the patents show wonderful skill of the artist and the reproducer.

It seems clear to us that mere "found sports" are not within the intent of the law—and if they are, that the law transcends the Constitutional authority of Congress. It is obvious that many novel and interesting problems have been started.

It doesn't seem to me that the flower or fruit necessarily goes with the plant, nor do I think Congress intended to protect the product of the plant. The question is, of course, enormously important. Process and machine patents do not protect the products. If it is possible to asexually reproduce the plant from the flower (or such part of the plant as goes with the flower) that is quite another question.

With all the foolishness shown in the Plant Patents thus far issued there is some consolation in the thought that probably all of the alleged inventions have actually been produced by some means or other. Which is more than can be said about most patents of the old school.

Dr. Joseph Rossman in an article published in the January 1931 issue of The Journal of the Patent Office Society discusses the background of the new law and many of its possibilities and also the Patent Office procedure.

Interesting comments on the subject of Plant Patents have been published in this Journal in August 1930 and in October and December, 1931. Anyone wishing to get a better background of the new law should read up the reports of the Senate and House Committees, which considered the subject, i. e., Senate Report 315, April 2, 1930 on S. 4015, introduced by Senator John G. Townsend, Jr., of Delaware, and the House Report 1129, April 10, 1930, both of the 2nd Session of the 71st Congress, and also the extracts from the hearings of the House, dated April 9, 1930, on H. R. 11372, introduced by Congressman Fred S. Purnell, of Indiana.

Apparently Senate Bill 4015 superceded S. 3530. It also appears that House Bill 11372 superceded H. R. 9765 and that on May 13, 1930 the Chairman of the Patent Committee of the House obtained unanimous consent to take up Senate Bill 4015, which was then passed. A motion to reconsider was laid on the table and the record shows "a similar House Bill was laid on the table." Presumably the latter bill referred to was H. R. 11372.

*Different climates do not necessarily affect all varieties alike. It is within the realm of possibility that conditions could be found under which all three varieties would ripen at the same time, or under which the relations of the three varieties would be reversed. EDITOR.

# THE PLANT PATENTS ISSUED IN 1932

Following is a list of the patents issued to January 1, 1933. The date, patentee, and text of the claims granted are given. In cases where the patent is of especial interest comments are appended. The claims and specifications of Plant Patents 1 to 4 are to be found in the JOURNALS for October and December, 1931.

Plant Patent 5, Nov. 10, 1931, to Victor Groshens, of Roslyn, Pa.: "The rose [mutation] as shown and described, characterized by petals having on the major portion of both sides the color of rose carthame."

A sport of the Talisman Rose.

---

Plant Patent 6, Feb. 16, 1932, to Robert Lee Catron, of Richmond, Indiana, Assignor to the Joseph H. Hill Company, of Richmond, Indiana: "A [hybrid tea] rose as herein shown and described, characterized chiefly by its true rose pink color, long buds, superior keeping qualities, and a flower which when half-opened gives a distinctive Gardenia-like effect."

$F_2$ selection Rapture × Souvenir de Claudius Pernet.

---

Plant Patent 7, Feb. 16, 1932, to James E. Markham, of Xenia, Illinois, Assignor to Stark Bro.'s Nurseries: "The [seedling] peach tree herein described, characterized by the lateness of the ripening period of its fruit as shown."

Result of a cross of the J. H. Hale and an unknown variety.

---

Plant Patent 8, Feb. 23, 1932, to George B. Hart, of Brighton, New York: "The new variety [mutation] of rose bush, herein shown and described, characterized by having roses in which the petals are a red color of a shade between spectrum red and carmine."

A bud sport of the Talisman Variety.

---

Plant Patent 9, Feb. 23, 1932, to Robert Lee Catron, of Richmond, Indiana, Assignor to Joseph H. Hill Company: "The hybrid tea rose herein shown and described, chiefly characterized by its yellowish-pink color, glossy green foliage, relative freedom from spines on the stem, long foliaceous sepals, and its free blooming, vigorous growing and disease resistant qualities."

Another Souvenir de Claudius Pernet (× unknown seedling) selection. Since being found in 1929 the seedling has been propagated and "developed"—whatever that means.

Plant Patent 10, March 8, 1932, to Joseph W. Kallay, of Painesville, Ohio, Assignor to Jackson & Perkins Company: "The [hybrid] climbing rose herein shown and described, characterized by its ever-blooming habit."

A scarlet everblooming climber. Why is not the color specified in the claim? See discussion by Mr. Allyn (Page 57).

---

Plant Patent 11, March 22, 1932, to Christian W. Hjermind, of Maywood, and Paul E. Weiss, of River Forest, Illinois, Assignors to Premier Rose Gardens: "The hybrid tea rose [mutation] herein shown and described, chiefly characterized by its rose red color, flushed with orange yellow, semi-double petalage, foliaceous sepals, heavy dark green foliage, and superior producing qualities."

The amazing "joint invention" discussed in detail on Page 50. The inventors do not reveal what variety this is a sport of!

---

### The Burbank Patents

Plant Patent 12, April 5, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, by Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The plum tree herein described, characterized by the ripening period [early] of its fruit and the freestone characteristic of its seed, as shown."

Plant Patent 13, April 5, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, By Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The plum tree herein described, characterized by the clear golden yellow color of the skin of its fruit as shown."

Plant Patent 14, April 5, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, by Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The plum tree herein described, characterized by the early ripening period of its fruit as shown."

Plant Patent 15, April 5, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, by Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The peach tree herein described, characterized by the ripening period and color of the skin of its fruit as shown."

Plant Patent 16, May 10, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, By Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The plum tree herein described, characterized by the

shape and color of its fruit and the size of its seed as shown."

A number of the patents issued to date have been granted posthumously to Luther Burbank, through his wife and executrix, Elizabeth Waters Burbank. The Stark Brothers Nurseries of Louisiana, Mo., have acquired the hybrids and selections of fruit trees which were left by Mr. Burbank, and all these patents have been assigned to the Stark Brothers Nurseries.

It is curious that these Burbank patents make no clear statements as to origin of the new varieties which are claimed. It is hard to see how a professional breeder is justified in claiming patents for new varieties without meeting this point. The situation is quite analogous to that of claiming a patent on a new chemical compound without disclosing either the chemical composition of the compound or the processes of originating it. This is all the more remarkable in view of such statements (Plant Patent 15): "This new variety of peach has resulted from years of experimenting with a definite objective in view, that is, to produce a satisfactory yellow free-stone peach, which ripens half way between the ripening period of the known varieties, the June Elberta, anl the early Elberta." Years of experimenting with a definite objective in view should give some inkling as to the parentage of the claimed variety, the failure to present any information on this point seems a serious defect and appears inconsistent with the claim of "years of experimenting" for a definite purpose. "Experimenting" that results neither in records nor interpretation of what has been done is simply puttering. Possibly Burbank carried all this information in his head. *In an era of plant patents accurate notebooks must assume a new importance.*

---

Plant Patent 17, May 24, 1932, to William Russell Elder, of Indianapolis, Indiana, Assignor to Elder and Elder Nurseries: "The variety of freesia [mutation] herein described and shown, characterized particularly by its large size, waxy white lily-like color, regular and pleasing shape, bright green foliage, and the relatively small size but great number of corms produced."

Plant Patent 17 is for a giant form of freesia, undoubtedly that described in the JOURNAL OF HEREDITY in 1929.* —"This new freesia is a mutation which first appeared several years ago in a planting of mixed freesia seedlings. * * * * The parents of these freesias were themselves seedlings from seed of several popular varieties of freesias. Some hand pollination has been done but pollination by bees had also taken place. Therefore the exact parentage is obscure." This statement is an excellent and honest explanation of a situation that unfortunately often arises in plant breeding.

The form of "mutation" which produced this new freesia is probably genetically different from bud mutation. In fact the use of that word in this connection may be unfortunate. Morgan expressed the view in his description of this freesia that chromosome irregularity may be the cause of the "mutation." Possibly heterosis, combination of size factors, or other genetic phenomena are involved. The discovery by crossing and selection of such a new form is distinctly a more inventive type of activity than merely finding and propagating a bud mutation.

---

Plant Patent 18, July 19, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, California, by Elizabeth Waters Burbank, Executrix, of Santa Rosa, California, Assignor to Stark Bro's. Nurseries: "The new and distinct variety of plum tree, characterized particularly by the chrome yellow color and firmness of the flesh of its fruit as herein shown and described."

---

Plant Patent 19, July 19, 1932, to Harold L. Ickes, of Hubbard Woods, Illinois: "The dahlia [hybrid] as herein shown and described, characterized by its color being Coral red, shading to Eugenia red towards the center, involute florets and strong healthy growing habits."

Text of part of specification on Page 51. Another phrase is important:— "From seedlings produced by such a crossing I invented and discovered my

*MORGAN, W. P. A New Variety of Freesia. *Journal of Heredity*, 20:356-58. 1929.

new variety of dahlia." This is an inversion of the use of the words *invent* and *discover* in the Constitution. Then *discover* was clearly used in the sense of invent. At present, *invent* is *not* generally used in the sense of *discover*, as is done here.

---

Plant Patent 20, August 23, 1932, to Earl H. Mann, of Richmond, Indiana, Assignor to E. G. Hill Company, of Richmond, Indiana: "The rose [mutation] herein shown and described, characterized by the deep, rich golden color of the major portion, gradually becoming lighter at its outer portion, its fragrance, long and stiff stems, and the pointed shape and long length of its buds."

Another Talisman sport. Yellow this time.

---

Plant Patent 21, August 23, 1932, to Earl H. Mann, of Richmond, Indiana, Assignor to E. G. Hill Company, of Richmond Indiana: "The rose [hybrid] herein shown and described, characterized by its deep cerise pink bloom, with a yellow base at its petals, its large and pointed buds, its sweet scented spicy fragrance, its long and strong stem, and its prolific production of blooms."

This patent announces the discovery of dioecious roses, as already discussed.

---

Plant Patent 22, August 23, 1932, to Charles N. White, of Medina, New York: "The variety of fragrant, semi-double hybrid tea rose herein shown and described, characterized particularly by its amber yellow color, its vigorous growing habits and relative freedom from thorns."

Bud sport of Joanna Hill.

---

Plant Patent 23, August 23, 1932, to Robert Lee Catron, of Richmond, Indiana, Assignor to the Joseph H. Hill Company, of Richmond, Indiana: "A rose [mutation] substantially as shown and described, characterized by its bloom being brilliant cerise in color, having a delicate and attractive fragrance of long duration, and in which the petals are unusually prolific and of very large size."

What does this mean: (*italics ours*): "More specifically stated, my present invention relates to a new and distinct variety of rose, the same being first naturally produced as a sport from a Briarcliff rose plant, then *manually* and *asexually developed scientifically*, whereby its characters have become fixed * * * *." Does "Manual science"= plant breeders' black magic?

Plant Patent 24, August 30, 1932, to William Sim, of Saugus, Mass.: "A carnation [seedling] as shown and described, characterized by a bronzy yellow color suffused with pink and with a white edge."

Selection of seedling produced "by crossing so called two unnamed seedlings."

---

Plant Patent 25, August 30, 1932, to Wallace R. Pierson, of Cromwell, Connecticut: "A variety of rose [mutation] as herein shown and described, characterized chiefly by its golden yellow color, full petalage, stems free of spines and thorns, and semi-glossy leaves."

*Another* Talisman sport. Pierson has the parent mutant still growing, and uniquely says so in the specification.

---

Plant Patent 26, August 30, 1932, to Bert W. Keith and Bud H. Keith, of Sawyer, Michigan: "The strawberry [seedling selection] herein shown and described, characterized by its conic to large conic shape, its firmness, and its fine canning qualities."

Some more "joint inventors," neither of whom seemed to have had much to do with "inventing" the new form.

---

Plant Patent 27, Sept. 20, 1932, to Louis F. Lambert, of Coatesville, Pa.: "A mushroom [of unknown origin] as shown and described, characterized by a white cap with floccose scales oxidizing to a pale buff or golden tint."

---

Plant Patent 28, Oct. 4, 1932, to Walter D. Brownell, and Josephine D. Brownell, of Providence, Rhode Island: "The rose as shown and described, characterized by the golden yellow color of its petals, the form and size of its bloom, its stiff long stem, the intense fragrance, and its remontant and ever-blooming habit."

This patent was obtained by the "joint inventors" (and such they seem really to be), not by a patent attorney. It is perhaps the most satisfying patent from a plant breeder's point of view thus far issued.

---

Plant Patent 29, Oct. 4, 1932, to Levi R. Taft, of East Jordan, Michigan, Assignor to Stark Bro's. Nurseries & Orchards Company of Louisiana, Missouri: "The cherry tree herein described, characterized by the lateness of ripening period of its fruit, as shown."

"—the new variety herein described is, with one exception, identical with the Montmorency. This refers both to the original tree and to second general

trees." Does it apply to first lieutenant trees, or to drum major trees? Why not to private trees?

---

Plant Patent 30, Oct. 4, 1932, to Levi R. Taft, of East Jordan, Michigan, Assignor to Stark Bro's. Nurseries & Orchards Company, of Louisiana, Missouri: "The cherry tree herein described, characterized by earliness of the ripening period of its fruit, as shown."

---

Plant Patent 31, Oct. 11, 1932, to Maurice A. Blake, of New Brunswick, New Jersey, Assignor to New Jersey State Agricultural Experiment Station, of New Brunswick, New Jersey: "The peach tree [seedling] herein described, characterized by the self fertile peculiarity of its flower, and the white fleshed characteristic, the color and [late] ripening season of its fruit, as shown."

Another Hale seedling. This is one of the excellent results of the peach breeding work of the New Jersey experiment station.

---

Plant Patent 32, Oct. 11, 1932, to Gerald Hew Dalrymple, of Bartley, Near Southampton, England, Assignor to C. J. Van Bourgondein, of Babylon, New York: "The freesia [seedling selection] as shown and described, characterized particularly by the "lavender-mauve" color and large size of its blossoms, the large number of blossoms per spike, four blossoms open at a time, and ample foliage of a light green color."

Originated in 1925 this variety was not distributed, and entire stock was bought by assignee in 1930.

---

Plant Patent 33, Oct. 11, 1932, to Paul M. Pierson, of Ossining, New York: "A hybrid tea rose [mutation] substantially as shown and described, characterized particularly by its rose to rose red color as distinguished from the rose pink to deep rose pink color of the somewhat similar variety known as Briarcliff."

One of our leading rose-breeders, and the originator of the Briarcliff, gets a patent on a Briarcliff mutation.

---

Plant Patent 34, Oct. 11, 1932, to Abner B. Shaw, of North Dartmouth, Massachusetts, Assignor to Stephen E. Shaw, of North Dartmouth, Massachusetts: "The variety [hybrid] of carnation herein shown and described, characterized particularly by its deep pink or red color tones, its large size and almost perfect form, its strong stem and calyx cup which prevents bursting, its vigorous growth and freedom from disease."

Plant Patent 35, Oct. 18, 1932, to Russell Engle, of Kokomo, Indiana, Assignor to Thomas L. Knipe, of Kokomo, Indiana: "The carnation [hybrid] as shown and described, characterized in unusually large flowers, the petals of which are generally a rich cream in color and streaked and tinged with flame and with pink."

Hybridization and selection (i. e. the inventive genius of the plant breeder), produce a variegated carnation.

---

Plant Patent 36, Oct. 18, 1932, to Jesse J. Broomall, of Eagle Rock, Calif., Assignor to Charles G. Reed, of Lawrence, Mass.: "A dahlia [hybrid] as shown and described, characterized by its white bloom having distinctive greater dimensions diametrically and axially and all parts of the bloom having relatively proportionate dimensions."

Remote descendant in selected progeny of species cross, *D. Juarezii* × *D. variabilis*.

---

Plant Patent 37, Oct. 25, 1932, to William Sim, of Saugus, Massachusetts: "The variety of carnation [seedling] herein shown and described, characterized particularly by the intense deep pink color of its blossoms, their full and almost perfect formation, delicate fragrance and extraordinary keeping qualities; and by the vigorous growing habits of the plant and its ease of reproduction due to the unusual growth of side shoots."

---

Plant Patent 38, Oct. 25, 1932, to Matthias Leenders, of Teyl, Netherlands, Assignor to Jackson & Perkins Company, of Newark, New York, a corporation of New York: "A new and distinct variety of rose, characterized by the bronze color of the flower, the length of the bud, and its prolific habit of growth as shown and described."

A seedling of (Ophelia × Mrs. Aaron Ward) × Souvenir de Claudius Pernet is unique "in the unusual color combination and tout ensemble," — which is *one* way to claim the earth and the fulness thereof.

---

Plant Patent 39, Oct. 25, 1932, to Percy W. Meredith, of Oregon City, Oregon: "A new variety [?] of brambleberry substantially as shown and herein described."

Typographical error in line 36—*Corà* for *Cory* thornless blackberry. Berry breeders wonder why this is not an old variety renamed, — perhaps Black Logan.

---

Plant Patent 40, Nov. 8, 1932, to William Gordon Sutherland, of Boulder, Colorado, Assignor to Stark Bro's Nurseries & Orchards Company, of Louisiana, Missouri: "A

new and distinct variety [seedling] of barberry characterized particularly by the absence of spines and the intense scarlet color of its leaves, as herein shown and described."

Color is *not* shown in the black-and-white drawing.

---

Plant Patent 41, Nov. 8, 1932, to Luther Burbank, Deceased, Late of Santa Rosa, Calif., by Elizabeth Waters Burbank, Executrix, of Santa Rosa, Calif., Assignor to Stark Bro's. Nurseries & Orchards Company, of Louisiana, Missouri: "A new variety of cherry tree as described, characterized by its vigor of growth, the toughness of its wood, and the large size and absence of susceptibility of cracking and rot of its fruit, as shown."

Another Burbank patent, that like all the others, gets around Section 4888 by ignoring the question of origin of the new form.

---

Plant Patent 42, Nov. 8, 1932, to Herman J. B. Wiederkehr, of Altus, Arkansas, Assignor to Stark Bro's. Nurseries & Orchards Company, of Louisiana, Missouri: "A new and distinct variety [?] of grape, characterized particularly by the early ripening, exceptionally large size, and superior quality of its fruit, as herein shown and described."

"To this end I have discovered and asexually reproduced my new variety of grape in that it increases the longevity of ripening season for grapes of the class to which it belongs." Beyond which respondent saith nothing regarding where, when, or how he came to "invent" his new grape.

---

Plant Patent 43, Nov. 8, 1932, to Edward A. Manda, of East Orange, New Jersey: "A freesia [seedling] as herein shown and described, characterized by its long pure white, gracefully tapering perianth and flat opening floral segments."

"The reproductive organs are both sterile and impotent." It is therefore a blessing that the originator did not "further improve this variety by intercrossing and other means."

---

Plant Patent 44, Nov. 22, 1932, Gerald Hew Dalarymple of Bartley, near Southampton, England, Assignor, to C. J. Van Bourgondien, of Babylon, New York: "The variety [seedling] of fresia herein shown and described, characterized particularly by its large orange colored flowers, profuse growth and blooming habits and rapidity of reproduction."

An *orange* freesia—entirely different from the colors heretofore known in freesia."

---

Plant Patent 45, November 29, 1932, to Emile J. LeDuc, of Danville, Pennsylvania: "The rose [mutation] herein shown and described characterized particularly by its large, strong, almost thornless stems, the very dark crimson scarlet shading of its flower and the maintenance of the persistency of these characteristics."

A sport of Scott's Columbia.

---

Plant Patent 46, November 29, 1932, to Oliver C. Cordrey, deceased, late of Salisbury, Maryland, by Hannah E. Cordrey and Eastern Shore Trust Company, Administrators, of Salisbury, Maryland, and Ernest W. Townsend, of Salisbury, Maryland, Assignors to said Ernest W. Townsend: "The variety of strawberry [seedling] as herein described and illustrated, characterized by its heavy plant growth, strong producing qualities, its early ripening of berries of superior color and shape, and having a distinctive sprightly, aromatic flavor.

Another of those "joint inventions." The first inventor made the cross and planted the seed. From the 100-odd seedlings the "second named joint inventor" picked out one—this new variety.

---

Plant Patent 47, November 29, 1932, to William H. Brake, of Rocky Mount, North Carolina: "A variety of pecan as herein shown and described, characterized particularly by its extraordinarily thin shell, its regularity of shape, its plump kernels of good flavor, its superior cracking-out qualities, its regularity and sureness of fruiting and its relative freedom from diseases.

The inventor's father planted five pecans picked from a single tree growing near Raleigh, N. C. Of the resulting seedlings this one is markedly superior.

---

Plant Patent 48, December 6, 1932, to George B. Hart, of Brighton, New York: "A new variety of rose bush herein described characterized by having roses in which the outside base of the petals is of light cadmium yellow in color, blending into alizarine pink, the inside of the outer petals being rose colored veined with Tyrian rose and the inner petals being eosine pink in color suffused with rose Tyrian, as shown."

"The object of this invention or discovery is to provide a distinct and new variety of rose and to provide a distinct and new variety of plant producing said rose * * * *." First the rose, then the plant to produce it, and *after*

*that* it turns out to be a sport of that sport-fecund Talisman variety. Of the twenty new varieties of roses patented, five are Talisman sports. Talisman will have to be renamed "Plant Inventor's Friend" if this keeps on!

---

Plant Patent 49, December 20, 1932, to Nicholas Grillo, of Milldale, Connecticut: "The hybrid tea rose [mutation] herein shown and described, characterized particularly by its large white flowers having conical or pointed centers, often slightly suffused with pink."

A "sport of the rose Grillodale, which in turn is a sport of Madam Butterfly."

---

Plant Patent 50, December 20, 1932, to James Didato, of Middlesex, New Jersey: "The variety of hybrid tea rose herein shown and described, characterized particularly by its reddish-pink buds, opening into a yellow flower with pink-tipped outer petals."

---

Plant Patent 51, December 20, 1932, to William F. Ramsey, of Okanogan, and Andrew T. Gossman, of Wenatchee, Washington; said Ramsey Assignor to said Gossman: "A variety of freestone peach of the J. H. Hale type as herein shown and described, characterized particularly by higher coloring, better flavor, almost entire absence of fuzz, firmer flesh and superior shipping qualities."

Tree found on property of first inventor (apparently not by him nor by the second-named joint inventor), is "observed, tested and reproduced" by the second-named inventor.

## Eugenics and Race Progress

In an address to the Eugenics Society, Mr. C. J. Bond, a well known surgeon, said that while recent reports showed great improvement in the general health of the school population, they provided no proof that natural intelligence and the innate capacity of mind and body were similarly improving. In spite of all the expenditure of time, money and energy on education, national health work, and the relief of unemployment during recent years, today one in every ten of our people was too dull or sickly to earn a living unaided, one in 200 was or had been mentally afflicted, and one in 120 was feebleminded. We had left heredity and eugenics out of our calculation and had been breeding from the less well endowed, the less fit and the less worthy stocks in our population. The tendency of the birth control movement had been to reduce the numbers of children born in the more educated, skilled and successful, rather than in the less fit groups. To that extent birth control had had a dysgenic effect on our population. Much of our social legislation was not founded on sound biologic principles. Helping the weak, necessary though it was, was done at the expense of normal citizens and was actually providing for handing on the burden of human inefficiency, defect and misery in an aggravated form to future generations. If the great advance in medical knowledge was to secure the best results for humanity as a whole, the medical horizon must be extended to include also the health and welfare of future generations. A great step would be gained if the nation realized and acted on the conviction that the future of Western civilization depended ultimately on the innate capacity and the mental and bodily qualities of our people. Innate capacity is a matter of human breeding. Before a proper biologic outlook on human life could come about, public opinion in regard to biology and genetics must undergo a change.

London Letter of *Journal of Amer. Med. Assoc.*, Jan. 14, 1933.

## Hybrid Corn Varieties Produce Highest Yields

The highest yielding varieties of corn in the 1932 cooperative tests conducted on eastern Nebraska farms by the state extension service, county farm bureaus, farmers, and the Nebraska experiment station were all hybrids. Out of the 35 different open pollinated varieties and hybrids used, the 18 highest producers were hybrids. The five best hybrids yielded 29 per cent more than the five best open pollinated varieties. In addition to making higher yields, the better hybrids were outstanding in strength of stalk, uniformity of stalk, height of ear and type of ear, and in general quality of the grain.

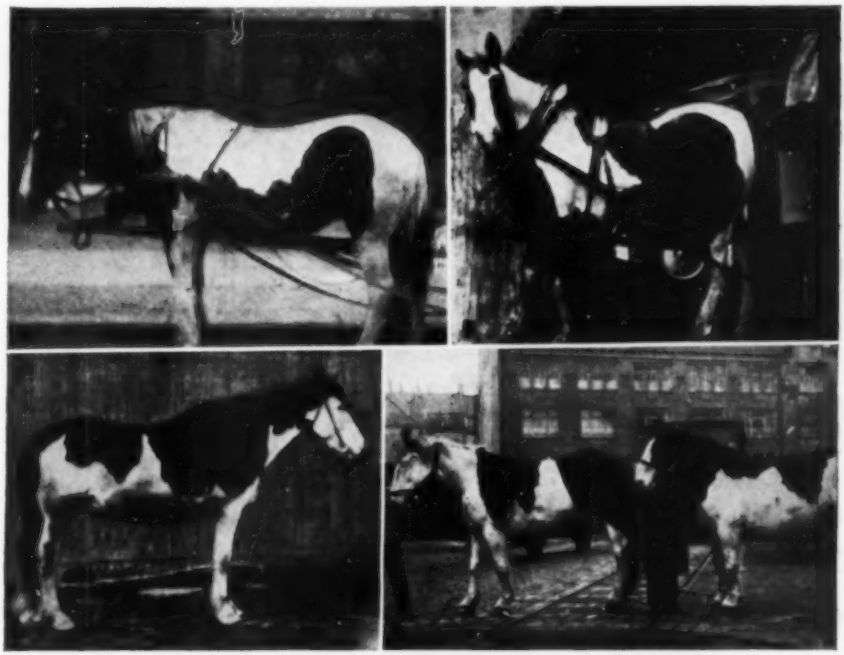
The five best hybrids averaged 67.88 bushels per acre, and the five best open pollinated varieties averaged 52.22 bushels per acre, thus showing an advantage of 15.66 bushels per acre in favor of the best hybrids. The hybrids in general averaged 57.09 bushels per acre, almost 7 bushels more per acre than the average for all of the open pollinated varieties used. The best open pollinated variety proved to be Krug. It yielded 54.52 bushels per acre, and its stalks stood up as well as any of the other varieties and better than most of them.

*University of Nebraska News Service.*

# THE "PIED" AND "SPLASHED WHITE" PATTERNS IN HORSES AND PONIES

V. KLEMOLA

*Institute of Animal Genetics, University of Edinburgh*



**DOMINANT AND RECESSIVE PIEBALD PATTERNS**

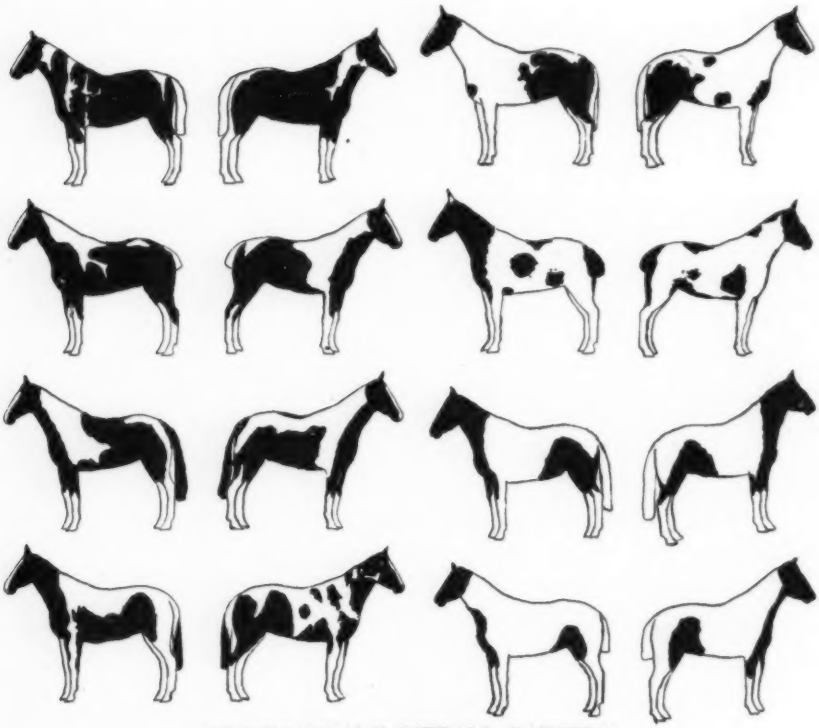
**Figure 1**

*A* and *B*—Characteristic cases of dominant piebaldness. Note the white dorsal patterns of *A* and *B*, and the white ventral patterns of *C* and *D*. *C* and *D*—Typical cases of splashed white pattern, with wall-eye. This pattern is recessive in inheritance.

IN animals white markings or patterns have many characteristic forms. Most of these types can be seen in our domestic species, for instance Dutch and Belgian rabbits, Friesian, Pinzgau, Hereford, Telemark, Lakenfeld, East Finnish and other breeds of cattle, most breeds of dogs, cats, etc.; some breeds of sheep and pigs also exhibit characteristic patterns.

The types of piebaldness vary from species to species. In smaller animals, the mode of inheritance has been studied by planned experimentation. In most species of our domestic animals, there is found a dominant and a recessive type of piebaldness. In many cases, as for instance in cattle, rabbits and sheep, the dominant and the recessive types are morphologically different.

In the better-known breeds of the horse, the piebald patterns are not common. From personal tests and observations made by the writer, the following results were obtained concerning this little-known subject. [A fuller de-



**THE DOMINANT PIEBALD PATTERN**

**Figure 2**

Illustrating dominant piebald pattern, without well-eye. The white areas are mainly dorsally distributed. Both sides of eight individuals are shown.

scription has been published in the *Zeitschrift für Züchtung,* Reihe B, vol. 20, pp. 24-78; that paper also contains references to literature.]

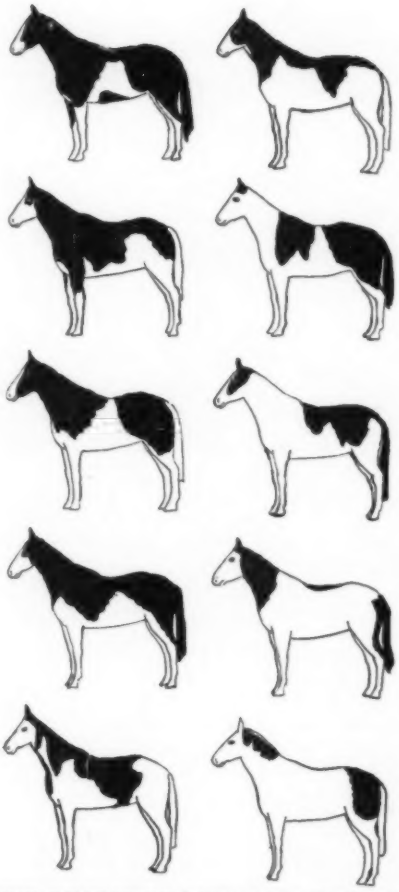
### Types of Piebald Pattern in Horses

In the first place there are horses which are so little marked that the body is of uniform color, and only the extremities of the legs ('socks'), muzzle and forehead ('blaze') are free from color. These horses are very common and attract no special attention. Indeed, in many breeds it is the horse without any white that is remarkable.

The heredity of this pattern is not quite clear because it is extremely complicated. There are presumably many factors and modifiers which play a part in the production of the various forms. To elucidate this question, special studies are necessary with a material containing the different types of patterns and their crosses. A paper by Buchanan Smith on white markings in the Clydesdale will appear shortly, which shows that the inheritance of these markings is of a recessive nature.

### Dominant Piebald Pattern

In the second place, we have a very rare type which is generally called "piebald," "skewbald" or "pied" (Buchanan Smith) These horses are much in demand for circuses. During the last decade, a German stud has chiefly preferred the progeny of a piebald stallion (Walther); in this way the markings



THE RECESSIVE PIEBALD PATTERN

**Figure 3**

Illustrating splashed white pattern, with wall-eye. The white areas are mainly ventrally distributed. The regions that are white in the dominant tend to be black in the recessive splashed white type and *vice versa*.

were practically certain to appear in the progeny, which later were distributed to different provinces and countries.

This type, in which one of the parents must always be pied, is a dominant form. The attached drawings are characteristic of this type. From them we can see that the white areas are present upon the neck, shoulder, back and croup. The color of the head and the eyes are normal. The tips of the ears are sometimes also white. Occasionally the colored and white areas are divided in the middle.

This is the true type of the piebald pattern which is to be met with in the breeds of oriental origin; it is also found among the American prairie and the pampas horses, and in various breeds of ponies, particularly the Shetland.

### Recessive Piebald or "Splashed White" Horses

In the native breeds of Northern Europe what at first glance looks like a piebald foal may be produced from quite normally-colored parents. This surprising phenomenon has given rise to many fantastic explanations among the breeders, and its appearance has been attributed to the effect of maternal impression.

It is obvious that this type is inherited in a recessive manner. In order to draw a sharper distinction between the two patterns, it is proposed to retain the term "piebald" only for the dominant type, while the recessive white pattern will be termed "splashed white."

In horses with this recessive "splashed white" pattern, unpigmented areas occur on the under-side of the body. The head is in a great measure white and the external membrane of the iris of the eye is also white; this last peculiarity is called a "glass" or "wall" eye.

The distribution of white areas on the body is best seen in the accompanying illustrations. When the drawings and photographs of the dominant and the recessive types are compared, there is seen to be a marked difference between them. The exact position of the last centers of pigmentation in the extreme grades of the two patterns is characteristic for each type respectively. Many of these extreme grades are, in a manner, complementary, as for example the black on the back in the recessive

types and the black on the ventral side in the dominant ones (cf. figures).

### The "Wall" Eye in Horses

Lack of pigmentation of the iris is unusual, but not unknown, in most breeds. Many other animals exhibit this character; in some breeds of rabbits it is even a breed characteristic, as for instance in the Dutch, the White Vienna, and also the modern Blanc d'Hôtot.

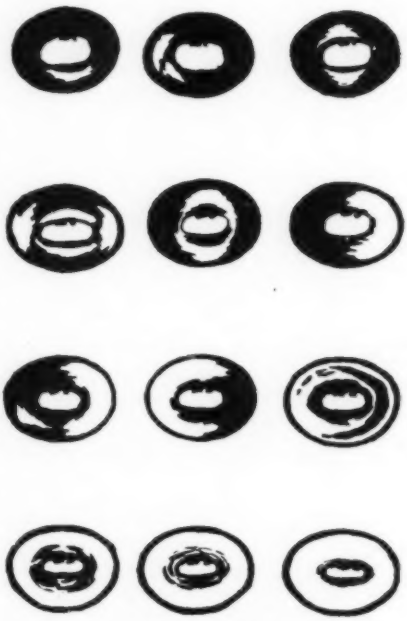
The white color of such an eye is due to the presence of uncolored areas on the external membrane of the iris. The color can be pure white or a little bluish, according to the thickness of the membrane.

The degree of lack of pigmentation of the iris is very variable. In the drawings of different eyes shown in Figure 4, there can be seen eyes with only very small white areas and also completely ringed wall eyes. In the photographs a similar range of variation is found.

### The Inheritance of Wall Eye and Splashed-White

The author has made observations and collected data which show that all the animals with the splashed white pattern always have a complete wall eye. This is not known in the dominant piebald type (cf. figures). The transmission of both these characteristics has been traced for eight generations in the pedigree and progeny of one Finnish stallion. In Norway, Baashuus-Jessen has also observed the occurrence of these two characters in the progeny of one stallion.

Records were collected from over the entire province of Ostrobotnia in Finland and comprised several thousand individuals. Out of the total there were found sixty-two wall-eyed animals; fifty-four of these were traced to the stallion Eversti and, according to the reports of the breeders, the other eight were also his progeny. Eversti himself was wall-eyed but had only extensive white markings and not the splashed white pattern. Of those sixty-two animals, sixteen had the complete (ringed) wall eye and they exhibited also the



**VARIATIONS IN WALL EYE**

**Figure 4**

Types of wall-eye; ringed wall-eyes are extreme cases. Apparently the wall-eye factor is associated with the splashed white pattern in inheritance.

splashed white pattern. Of eleven normal-eyed sons of Eversti, which were used most for breeding, all transmitted the wall-eye and five also the splashed white pattern. Among the progeny of those five stallions there were nineteen wall-eyed, of which ten exhibited the splashed white pattern and nine did not.

The numbers indicate that the ratio of splashed white: wall eye is 3:1. When the progeny of animals heterozygous for splashed white pattern is considered, the ratio of splashed white: wall eye is nearly equality.

It would appear that there is a close association between the splashed white and the wall-eye characters. The exact nature of this association is not yet clear. It may be suggested, that they are based on two factors which may form

an allelomorphic series, the splashed white factor being recessive.

It may also be suggested that both these characters are modifications of the same phaenotype and may be based on one and the same factor. This, however, is improbable because, as has already been stated, in the Clydesdale the wall-eye may be present alone, though this condition is comparatively rare. Calder reports that he found most cases of wall eye among the progeny of three stallions, which may have had common ancestors. His material consisted of forty-eight cases and he found that the number of cases increased with the degree of inbreeding. The present material also is derived from a line which has been fairly closely inbred.

It would appear therefore that the factors for splashed white and wall eye are distinct but closely associated. The study of pedigrees indicates that they are probably multiple allelomorphs. From the material so far available only a provisional interpretation can be given of the mode of inheritance of the splashed white pattern. Further studies, involving crosses of different types, are necessary before this can be made definitely clear.

### Preference for Piebald Ponies

According to the information of pony breeders, there is a decided preference for piebald ponies in Britain, America and some other countries, and special efforts are therefore made to breed this type. The dominant type particularly is widely distributed and bred. For instance in the British Shetland pony breed there are stallions which sire only piebald progeny. This is remarkable, as such animals must carry the dominant factor for this condition in a double dose, i e., be homozygous piebald.

In horses this is rare. The photographs and the extreme grades in the diagrams show what such homozygous types of the dominant piebald pattern would look like.

### Have the Piebald and the Wall Eye Factors any Deleterious Effects?

It is known through various experiments that many genetic characters, especially of the recessive type, have an injurious or even a lethal influence or are associated with some weakness or abnormality in constitution. For instance in dogs, animals showing the brindled or spotted patterns are often congenitally deaf, have a coloboma of the eye or exhibit other defects. In the Norwegian Dunkerhound, Wriedt described a similar case.

In horses no association could be discovered between any defect and the splashed white pattern. The wall eye has practically the same ability to see as the normal save that the opening of the pupil is seen in daylight to be a little smaller. Probably, therefore, horses with complete wall eye are more inclined to shy, since the visual area is restricted; but practically this is of no importance. In regard to the working strength of piebald horses, it is breeders' superstition that the piebald animals are more resistant and stronger than the normal. This is pure imagination, which has no foundation in fact.

The author wishes to thank Miss M. V. Cytovich, of the Imperial Bureau of Animal Genetics, Edinburgh, for her help in the preparation of this paper.

## Books Received

*BOOKS are acknowledged in this column as received, and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. As far as space permits, books that contain material of special interest to the readers of the* JOURNAL *will be reviewed in later numbers.*

PROCEEDINGS OF THE SIXTH INTERNATIONAL CONGRESS OF GENETICS. Ithaca, New York, 1932, Volume 2, Condensed Articles and Descriptions of Exhibits. Published at Menasha, Wisconsin, by the Brooklyn Botanic Garden, Brooklyn, N.

Y. 405 Pages. Price, two volumes, $15.00.

A condensed cross-section of genetic thought and activity thirty-two years after the rediscovery of Mendelism.

---

MORPHOLOGISCHE UNTERSUCHUNGEN AN DER FIBULA DES MENSCHEN UNTER BERUCKSICHTIGUNG ANDERER PRIMATEN, *by* HEINRICH SPRECHER. 161 Pages. Art Institut Orell Fussli. Zurich, 1932.

Much ado about leg bones of Homo and his cousins.

---

KORPERFORM UND LEISTUNG SECHZEHNJAHRIGER LEHRLINGER UND MITTELSCHULER VON ZURICH, *by* ERNEST BIEDERMANN. 382 Pages. Art. Institut Orell Fussli. Zurich, 1932.

How Swiss high-school children are put together in a statistical-anthropological sense.

---

POPOLAZIANI AFRICANE, *by* LIDIO CIPRIANI. Italian Committee for the Study of Problems of Population. Italian Society of Genetics and Eugenics. Series II, Vol. III, 166 Pages, Five Chapters, Bibliography. R. Bemporad & F. Editori—Firenze. 1931.

With the Fascist "Battle for Births" becoming a rout, and the birth rate falling in spite of much ballyhoo, perhaps Italian interest in African colonization will be less urgent.

---

L'IMMIGRAZIONE DEGLI EBREI IN PALESTINA NEI TEMPI MODERNI, *by* REUBEN KAZNELSON. Italian Committee for the Study of Problems of Population. Series I, Vol. II. 92 Pages. Three Sections. 30 Chapters. Bibliography. Tipografia Failli, Roma, 1931.

The modern Exodus to the Promised Land from Egypts as wide as the world.

---

THE SMALLEST LIVING THING, *by* GARY N. CALKINS, PH. D., Sc. D., Professor of Protozoology, Columbia University and at the Marine Biological Laboratory. Eleven Chapters. Suggestions for Further Reading. Glossary. Index. 135 Pages. The University Society, New York.

ENERGY AND MATTER, Building Blocks of the Universe, *by* CHARLES B. BAZZONI, PH. D., Professor of Experimental Physics, University of Pennsylvania. Nine Chapters. Suggestions for Further Reading. Glossary. Index. 133 Pages. The University Society. New York.

SPACE, TIME, AND RELATIVITY, The Einstein Universe, *by* H. HORTON SHELDON, PH. D., Professor of Physics, New York University. Relativity. Five Chapters. Two Appendices. Suggestions for Further Reading. Glossary. Index. 104 Pages. The University Society, New York.

THE RACES OF MAN, Differentiation and Dispersal, *by* ROBERT BENNETT BEAN, M. D., Professor of Anatomy, University of Virginia. Ten Chapters. Appendix. Suggestions for Further Reading. Glossary. Index. 134 Pages. The University Society, New York.

Columbia's University Society doing its bit to get the light of knowledge out from under the bushel of the abstruse. Some of these interpretive bright spots shine more brilliantly than others.

---

EUGENIK UND WELTANSCHAUUNG, *by* BERNHARD BAVINK, HERMANN MUCHERMANN, KARL VALENTIN MULLER, under the editorship of GUNTHER JUST. Four Chapters. 196 Pages. Alfred Metzner Verlag. 1932.

German authorities get together to tell the world what Eugenics offers in the way of outlook on present conditions.

---

SEX AND INTERNAL SECRETIONS, A Survey of Recent Research. Twenty-one Contributors. Edited by Edgar Allen University of Missouri, with a foreword by ROBERT M. YERKES, Yale University. Issued under the auspices of the Division of Medical Sciences of the National Research Council. Nineteen Chapters. 951 Pages. Price $10.00. The Williams & Wilkins Company, 1932.

Much ado about almost nothing, when we consider what amazingly small quantities of some of these internal secretions produce profound effects on the organism.

---

ERBBIOLOGISCHER UND EUGENISCHER WEGWEISER FUR JEDERMANN, *by* KONRAD DUERRE. 95 Pages. Alfred Metzner Verlag. 1932.

The Eugenic light rather well from under the bushel for German readers.

---

GROWTH AND DEVELOPMENT OF THE CHILD, Part IV, Appraisement of the Child, Mental Status—Physical Status, Report of the Committee on Growth and Development, *by* KENNETH D. BLACKFAN, M. D., Chairman, White House Conference on Child Health and Protection. Royal 8 vo. 344 Pages. Price $2.75. The Century Co., New York.

How American children are put together—from many points of view.

# SPURLESSNESS OF THE WHITE LEGHORN

A. W. KOZELKA*

*Whitman Laboratory of Experimental Zoology, The University of Chicago*

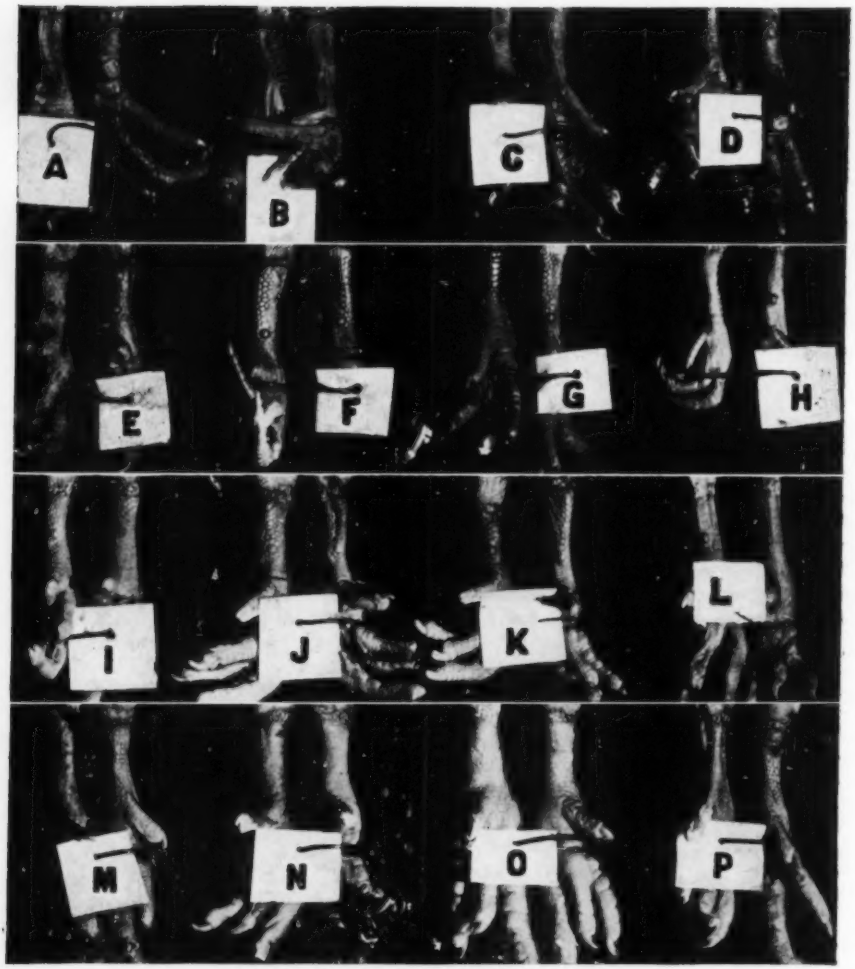
IN the summer of 1929 three spurless chicks were hatched among a large number obtained from a breeder of white Leghorns in Pennsylvania. This Leghorn strain had supposedly been line bred for twenty years and the eggs were derived from six half sisters mated to a half brother. Upon examination of the general Leghorn stock, it was discovered that the females showed considerable variation in spur size. The variation ranged from total absence of spurs to spurs approximately the size of a male spur. In the males of this strain the spurs exhibit only normal variation. Of the six hens from which the eggs were obtained, two had abnormally developed spurs, one having spurs measuring 13 and 2 mm. respectively; the other, 5 and 2 mm. The spur measuring 13 mm. was attached to the shank bone. The male had normally developed spurs. The male (Figure 6*A*) and one of the females (Figure 6*G*) used in the original matings were derived from the female with the one masculine spur described above; the other female (Figure 6*H*) was hatched from an egg from a half sister that had typically feminine spurs, though also slightly asymmetrical.

### Description of the Character

The appearance of the spurless condition in day-old chicks of both sexes is illustrated in Figure 5*A-D* and *M-P*. Figure 5*D* illustrates the condition referred to in the text as a slight vestige. Actually the vestige at this age, as revealed by a microscopic examination, is only a slightly enlarged scale of the type found in the surrounding region. The spurless condition may or may not be accompanied by the absence of scales along the inner region of the shank. In Figure 5*A* and *B* the scales are absent along the inner region of the shank (see also Figure 6*F* for appearance of the abnormality in an older bird); in Figure 5*C*, *N* and *O* an intermediate condition is evident; and in Figure 5*D*, *M* and *P* the scales are quite normal.

Birds eight or more months of age showed some indication of sexual dimorphism. In males of this age general outgrowths were apparent in the regions of the spurs. These became more and more pronounced until eventually in some of the older birds the bony outgrowths broke through the integument taking on the appearance of deformed spurs. Actually the integumental portion was totally lacking except in those cases where a slight vestige was evident at time of hatching. In these cases the disc shaped vestige formed the apex of the outgrowth but even these always remained decidedly smaller than a normal female spur, even in male birds over a year of age. The development of the bony growth from the shank bone is well illustrated in Figure 6*F*, *E*, *D* and *A*. Figure 6*F* is an illustration of a bird that showed slight indication of a vestige of a spur on each shank at time of hatching. The slight elevation in this case is entirely integumental; dissection revealed a slight pocket in the integument without a corresponding outgrowth from the shank bone. There was, however, a slight thickening of the ligament in the region of each spur. Figure 6*E*, right shank, illustrates the characteristic growth from the shank bone in a male

* I wish here to express my appreciation of Prof. F. B. Lillie's consideration in his laboratory which enabled me to carry on this and other investigations during the two years I worked under his direction as Fellow of the National Research Council. The expenses of this investigation were borne in part by the Committee for Research in Problems of Sex of the National Research Council and the University of Chicago.




**SPURRED AND SPURLESS SHANKS**

**Figure 5**

Upper row (*A-D*)—Spurless offspring from a matings of male 838, 6*D*, with females illustrated in Fig. 6 *G*, *H*, *I*, and one other spurless female not illustrated. *A* and *D*, it will be noted, have slight vestiges of spurs. Shanks shown in *E* and *G* are of offspring from females 487 (Fig. 6*G*) and 502 (Fig. 6*H*) mated to a brown Leghorn male. *F* and *H* show shanks of individuals from a reciprocal cross of male 838 (Fig. 6*D*), mated to two spurred females. Shanks shown in *I*, *J*. *K*, are of spurred individuals from a back-cross of the hybrid females mated to male 838 (Fig. 6*E*). The bottom row (*M-P*) shows the shanks of spurless individuals from the same mating. At *L* are shown the normal spurs on a day-old brown Leghorn chick.

bird at approximately one year of age; Figure 6*D*, at fifteen and one half months of age; and Figure 6*A*, at twenty months of age. Only in the latter case did the bony outgrowth break through the integumental tissue and then it broke through only on one shank as is evident from the illustration. While the bony growth appears to be like that of a normal spur, the integumental portion was totally lacking. This case represents the extreme development encountered in these experiments.

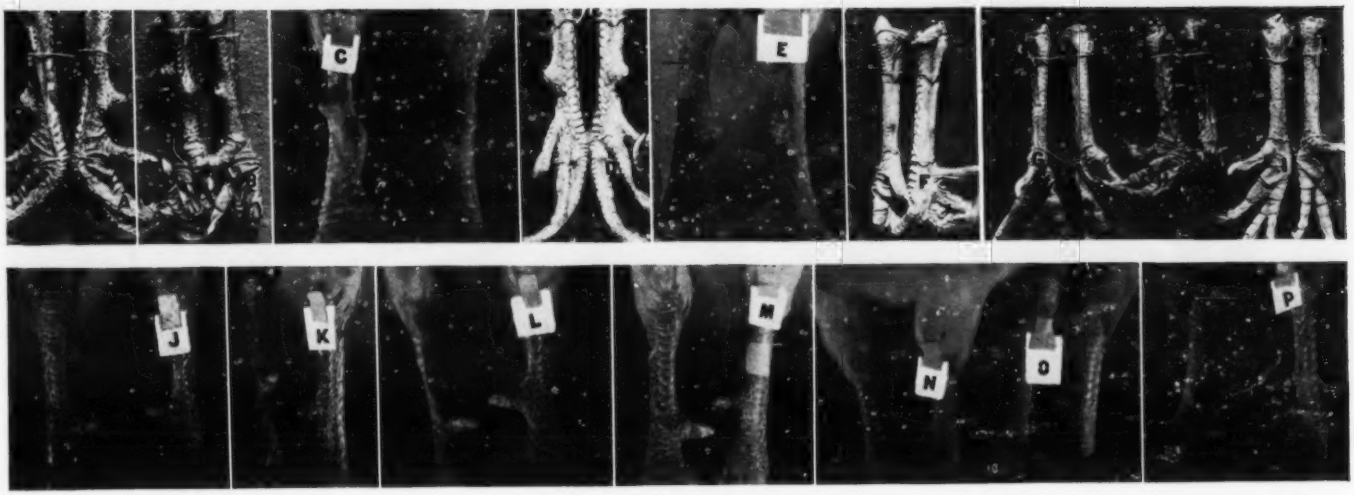
Removal of the integument, in all cases revealed a bony growth from the shank bone of the general shape shown in the photographs; the integument was only of ordinary thickness. That the integument was not the factor that induced the bony growth in the region of the spur is well demonstrated in the cases of birds 888, 887 and 922, Figure 6*E*, *B* and *C*, respectively. In the case of 888 there was no evidence of a vestige of a spur at time of hatching. While a transplant from the region of the left spur (Arrow in Figure 6*E*), remained ordinary scaly tissue, the bony structure in the true spur region developed in the manner characteristic of this strain. In fact, growth was more pronounced than in the control. This probably was due to release of integumental tension, which undoubtedly acted as an inhibitor. The same is true of the two cases in which a slight vestige was evident at time of hatching (Figure 6*B*, *C*). In each case, especially the latter, growth was actually stimulated by the removal of the integument, a condition that was never observed upon the removal of a spur in infantile chicks in normal strains of Leghorn. However, a slight growth was occasionally observed in males of normal strains when the spur was removed in more advanced stages of development. How the excessive development of the transplanted vestige in birds 887 and 922 is to be accounted for, is difficult to explain. The transplant of bird 887 is a normal appearing spur in contrast to disc-like vestige of the control. That of 922 is merely a soft outgrowth covered, except for the apical portion, with ordinary scaly tissue. The vestige spur covering the apical portion is practically identical with that of the control. While a transplanted spur in normal strains of birds was usually larger than the control several months after the operation, excessive development of the type encountered in birds 887 and 922 was never observed.

The females, with one exception, retained the undifferentiated condition of the spur (Figure 6*G*, *H*, *I*). In this particular case there was a slight outgrowth from the shank bone in the region of each spur without any corresponding integumental structure.

The condition here described is quite different from that found in normal strains of Leghorns. At time of hatching the spur of either sex is a small oval thickening of ectoderm (Figure 5*L*). In the female it normally remains a comparatively small oval, movable structure throughout the life of the bird (see Figure 6*N* for type); in the male it continues to develop and eventually becomes attached to the shank bone by a fusion of the bony core of the spur with the outgrowth from the shank bone induced by the presence of the spur (unpublished data). Removal of the spur in infantile male chicks prevents the development of the outgrowth from the shank bone. That the primordium for the bony core in a spur is already present in a day-old chick is demonstrated by the transplantation of the spur to a fleshy portion of the body; such spurs always had normal appearing medullary portions (Kozelka, '32).

### Breeding Results

All the matings made while studying the spurless character were completely controlled so that there is no possibility of mistake in the parentage of the progeny herewith presented. The matings were made in separate breeding pens and in the back cross of the spurless to hybrid and hybrid to hybrid matings the eggs were trap-




## SPUR DEVELOPMENT

**Figure 6**

*A*—Original male 497. The spur-like structure is actually the bony outgrowth from the shank bone which broke through the integument after the fourteenth month. The integumental portion, normally found in the Leghorn breed, is absent in both spurs. Died at 20 months of age. *B*—Male 887. Right leg, vestige in the normal situation nine months after hatching; left leg, transplant from site of the left spur, transplanted in the infantile chick. The latter had all the characteristics of a normal spur. In the day-old chick a slight vestige was evident on each shank comparable to the one illustrated in Fig. 5*D*. *C*—Male 922. Right leg, control 46 weeks after hatching; left leg, transplant from region of left spur grafted at present location in the infantile chick. The transplanted outgrowth consists of spongy material covered with ordinary scaly tissue with a disc-shaped vestige at the apex. A similar vestige is also present, though not evident in the photograph, on the right shank. The vestiges were evident in the day-old chick appearing like the one illustrated in Fig. 5*D*. Note the bony outgrowth in the region from which the integument has been removed: this has increased considerably in size, without a corresponding increase on the right shank, since the time the bird was photographed. *D*—Male 838. Showing characteristic growth in the region of the spurs of the spurless strain of a bird 15.5 months old. *E*—Male 888. Right leg, control; arrow shows the undifferentiated integument from the region of the left spur transplanted to present region in the infantile chick. In this case there was no evidence of vestiges. Note the excessive development in the region of the left spur from which the integument was removed. Photographed when the bird was 51 weeks old. *F*—Male 841. Showing at approximately six months of age the region of the spurs of a bird in which there was a slight evidence of vestiges on each shank when the bird was a day old. *G*—Original spurless female 487. Died 20 months of age. *H*—Original spurless female 502. Died at 27 months of age. *I*—Female 856. Died at 13 months of age. *J* and *K*—Males 950 and 1113, respectively; Hybrids from matings of spurless male with spurred females. Male 950 was 40 weeks old at time it was photographed; 1113, 36 weeks. *L* and *M*—Males 952 and 965, respectively. Hybrids from matings of spurred male with spurless females. Male 952 was 40 weeks old at time it was photographed; 965, 37 weeks. *N* and *O*—Females 915 and 948, respectively. Hybrids from matings of spurred male with spurless females. Bird 915 was 46 weeks old at the time it was photographed; 948, 40 weeks. *P*—Female 984. Hybrid female from mating of spurless male with spurred female. The spur on the right shank is characteristic of the spurs on mature females from this cross; the one on the left was removed when the bird was only a few days old.

nested in order that individual studies could be made of the progeny of each hen.

In the original matings male 497 (Figure 6*A*) was mated to his full sister (No. 487, Figure 6*G*) and to a half sister (No. 502, Figure 6*H*). None of the three birds showed any indication of spurs at time of hatching, which condition as previously described persisted in the two females but in the male a general outgrowth appeared in the region of the spur after the eighth month. While the structure on the right shank has the appearance of a normal spur, the integumental portion, characteristic of the normal spur in Leghorns, is lacking. The part evident is the bony outgrowth from the shank bone which broke through the integument after the fourteenth month. The rudiment on the left shank, it will be noted, is still enclosed within the scaly integument.

Eighteen chicks were obtained from these matings all of which were spurless at time of hatching. Two, however, showed a slight vestige on each shank and four on only one shank. Figure 6*F* shows the regions of the spurs of bird 841 at approximately six months of age. This bird had a slight vestige on each shank. Figure 6*D* (No. 838) is an illustration of the shanks of one of the birds designated as having a slight vestige on only one shank. The slight elevations in the regions of the spurs of 841 are entirely integumental in nature, as revealed by a dissection, but in no way resembled a normal spur; those on 838 (Figure 6*D*) are characteristic bony outgrowths from the shank bone. Bird 856 (Figure 6*I*) was a female, derived from the above mating, which at no time in its life showed evidence of a spur growth. Only seven of the eighteen birds from this mating lived more than a week and these all died at a comparatively early age.

The following spring the two original females 487 and 502, together with two of the daughters (Nos. 845, 856, Figure 6*I*) were mated to an $F_1$ male (No. 838, Figure 6*D*). From these matings 28 additional spurless chicks were obtained of which six had a slight vestige on only one shank and three on both shanks. Figure 5*B* and *C* are illustrative of the birds that were totally spurless and Figure 5*A* and *D* show shanks of individuals from this mating with slight spur vestiges as infantile chicks. Of the eight individuals that grew to maturity from this mating numbers 887 (Figure 6*B*) and 922 (Figure 6*C*) showed slight vestiges as day-old chicks; number 888 (Figure 6*E*) is representative of those that showed no indication of vestiges of spurs at any age. The integumental portion of the control vestige in birds 887 and 922 is merely a disc shaped scale in direct contact with the bony outgrowth from the shank and decidedly smaller than a normal female spur. Except for the slight vestige, the general outgrowth from the shank bone is not unlike that of the individuals in which no vestige was evident. On the other hand, the grafted portion of 887 is quite similar to that of a normal male spur while that of 922 is merely a soft general outgrowth covered with ordinary scaly tissue. In contrast to the behavior of the transplanted regions of the spurs in the two above cases, the transplanted integument from the region of the left spur of 888 showed no signs of development (Figure 6*E*). In this case there was no indication of a vestige at time of hatching. This, however, did not in any way inhibit the outgrowth from the shank bone. In fact, the removal of the integument from the region of the spur promoted the development as was previously indicated under the description of the character. This would seem to indicate that the bony outgrowth from the shank bone in this strain is independent of the integumental portion, a condition that is quite different from that found in normal strains of birds.

During the late spring of the second year of the experiment the two original females, 487 and 502, were mated to a spurred male from the general stock of brown Leghorns maintained at the

laboratory. A total of 29 chicks were produced by this mating, all of which were normally appearing spurred birds. This is well illustrated by Figure 5*E* and *G* of day-old chicks and by Figure 6*L*, *M*, *N* and *O* of the matured birds. The four birds pictured in the four latter figures are the only ones that grew to maturity; all the remaining individuals from this mating either failed to hatch, though fully developed, or died at an early age. In the reciprocal cross male 838 (Figure 6*D*), the same male used during the earlier part of the season with the spurless females, was mated to two brown Leghorn hens from the same general source as the male in the reciprocal cross. The 26 individuals from these matings were likewise normal appearing spurred birds. Figure 5*F* and *H* are of spurs typical of this group as they appeared upon hatching; Figure 6*J* and *K* of 950 and 1113, respectively, are characteristic of the spurs of the eight males that lived until maturity. The spur in Figure 6*P* is illustrative of spurs of the nine adult females.

All of the spurs on the 55 individuals from the reciprocal crosses were fully as large as spurs on birds of corresponding ages of normal spurred strains. This is well illustrated by a comparison of the spurs in day-old chicks illustrated in Figure 5*D*, *E*, *F* and *G* from birds of the reciprocal crosses with the spurs illustrated in Figure 5*L* of a brown Leghorn chick from normal spurred stock. The spurs on matured birds were likewise characteristic of the spurs of their respective sexes in the Leghorn breed as is indicated by the illustrations of the hybrids.

In a backcross of spurred hybrid females (from the mating of the spurless male with spurred females) to a spurless male, 888 (Figure 6*E*), 60 offspring were obtained: 27 spurred, 32 spurless and one with a well formed spur on one shank and none on the other. Of the 32 individuals classified as spurless, three showed a slight vestige on both shanks and one on only one shank. The individuals classified as spurred showed somewhat more variation in size of spur than the spurred hybrids from the two preceding crosses. With the exception of the one individual with asymetrically developed spurs, there was no difficulty in the classification of the individuals from this mating. This is well demonstrated by the type individuals shown in Figure 5*I-K* inclusive and *M-P*. Figure 5*I* is of one of the smallest spurs from the mating; *J* and *K* are of the most common type of spurred individual; *L* is of spurs on a chick from a normal strain; *M-P* are of the spurless individuals. Of the eight females used in the matings, each produced at least one spurless individual in this mating.

From matings of the same hybrid females to a hybrid male from the reciprocal mating (No. 965, Figure 6*M*), 102 spurred and 36 spurless chicks were obtained. In the spurless group four individuals each had slight vestiges on one of their shanks and one on both shanks. In the spurred group all had well defined spurs. There was some variation in size but probably no greater variation than would be found in any lot of chicks from normally spurred birds.

## Discussion

The only previous genetic study of an abnormality of the spur as far as the writer is aware is that of Goodale,[25] and that was of the inheritance of a spurred condition in females. The character was recessive but apparently a number of factors were involved.

The results in the present experiments indicate that the spurless condition is also inherited as a Mendelian recessive but with only a single factor difference between the spurred and spurless condition. Spurless crossed with spurless in each case gave only spurless individuals. Reciprocal crosses of spurless with spurred individuals produced only spurred birds. A backcross of spurred hybrid females with a spurless male resulted in a close approximation to a 1:1 ratio. Matings of

hybrids of reciprocal crosses gave approximately 3:1 ratio. An absolute demonstration that the character is recessive can only be made from mating of the segregates. It is not improbable that future work will reveal one principal factor and minor modifying factors. This is suggested by the occasional appearance of slight vestiges in the day-old chicks. These may be comparable to the variation encountered in genetic studies of characters in other species of animals, i. e., the recessive eyeless condition of *D. melanagaster*. This character shows considerable variation even in highly inbred strains homozygous for the character.

The occasional asymmetrical condition encountered in this character is not at all unexpected. It was especially marked in the spurred form of the mother of the two original spurless individuals and again expressed itself in the asymmetrical bony outgrowths from the shank bone in the original spurless male. Therefore, it is not surprising that the asymmetrical condition recurred in the succeeding generation in varied forms. In this connection also it is to be noted that asymmetry of various structures is rather common in practically all forms of bilaterally symmetrical animals, as for example, the eyeless condition in *D. melanogaster* and polydactylism in various species of mammals.

Excessive development of the grafted vestige as compared with the control is difficult to explain unless it be supposed that transplantation serves as a stimulus. It is also possible, though not probable, that certain inhibiting factors exist in the region of the spur and not in other regions of the shank; transplantation of the vestige removed it from its normal controlling mechanism. Only additional work can hope to reveal the factors responsible for the differential growth rate.

That the spurless condition is not sex-linked is indicated by the presence of spurless and spurred individuals of both sexes among offspring from the cross of spurless male with spurred females.

There is evidence that the spurless condition is somehow associated with vitality. The fact that only a small percentage of the spurless chicks from matings of spurless by spurless showed low viability would not be significant inasmuch as the birds were inbred but it does appear significant that only 2 spurless of 9 birds from the back cross survived up to three months of age where a close approximation of a 1:1 ratio was obtained. There is an indication that approximately the same ratio of mortality among spurless and spurred chicks will be maintained in the segregates from the hybrids of reciprocal crosses. Of the 35 living birds from this cross, ranging in age from one to eight weeks, only 5 spurless individuals survived whereas the proportion of spurred to spurless from the cross was a close approximation to a 3:1 ratio.

It is of interest to note that a sexual dimorphism, characteristic of the other secondary sexual structures, is also evident in this character. Whether the factors responsible for the dimorphism in normal spurred strains are effective in this strains with regards the spurless character is not known.

## Summary

Three spurless chicks hatched among a number of normal spurred individuals from a strain of white Leghorn which exhibited considerable variation in the female spur, the variation ranging from total absence, to spurs that were approximately the size of a male spur. The spurless condition is apparently due to the absence of the integumental portion normally found in the ordinary spur. At time of hatching both sexes are spurless or, at most, show a slight vestige of a spur but after sexual maturity sex dimorphism appears in the form of a bony outgrowth from the shank bone in the region of the spur of the male; while in the female, on the other hand, no such growth takes place. Genetic evidence indicates that the spur-

less condition is inherited as a Mendelian recessive with only a single factor difference between the spurless and the normal.

The spurless condition is apparently associated with a reduction of vitality. A significantly smaller proportion of the spurless segregates survived than the spurred.

## Literature Cited

GOODALE, H. D. 1925. Data on the inheritance of spurs in the female of domestic poultry. *Anat. Rec.*, vol. 31, p. 343.

KOZELKA, A. W. 1932. Spurlessness of the White Leghorn. *Proc. Sixth Int. Cong. Genetics.* Vol. 2, p. 261.

————. 1932. Integumental grafting as a means of analysing the factors determining the secondary sexual characters of the Leghorn fowl. *Jour. Exper. Zool.*, vol. 61, pp. 431-495.

STRUTEVANT, A. H., C. B. BRIDGES, T. H. MORGAN, L. V. MORGAN, JU CHI LI. 1929. Contributions to the Genetics of Drosophilia simulans and Drosophilia melanogaster. *Carnegie Inst. of Wash. Pub. No. 399.*

**TABLE I.—Summary of Spurless Crosses**

*SS*, represents homozygous normal; *ss*, homozygous spurless; *Ss*, hybrids. phenotypically normal. Part 1 is the original mating of spurless male with two spurless females; 2, the mating of two original females and two of their daughters from original mating with a male from the same mating; 3, the mating of a spurred male with the two original spurless females; 4, the mating of a spurless male with two spurred females; 5, mating of a spurless male with spurred hybrid females from preceding mating (4); 6, the mating of the same spurred hybrid females used in the preceding mating with a spurred hybrid male from reciprocal cross (mating 3).

| Type of Mating | | Progeny | |
|---|---|---|---|
| | | Normal | Spurless |
| 1. ♂ × ♀ | | | |
| | *ss* *ss* | 0 | 18 |
| | Expected | 0 | 18 |
| 2. *ss* × *ss* | | 0 | 28 |
| | Expected | 0 | 28 |
| 3. *SS* × *ss* | | 29 | 0 |
| | Expected | 29 | 0 |
| 4. *ss* × *SS* | | 26 | 0 |
| | Expected | 26 | 0 |
| 5. *ss* × *Ss* | | 27 | 32* |
| | Expected | 29.5 | 29.5 |
| 6. *Ss* × *Ss* | | 102 | 36 |
| | Expected | 103.5 | 34.5 |

*One individual not included in the data was hatched from this mating with a well formed spur on one shank and none on the other.

## Probability Tables for Mendelian Ratios

WHERE small numbers are involved, as is usually the case in genetic studies of the larger mammals and always in human genetics, the fitting of observed progeny distributions to Mendelian expectation offers difficulties. Ordinary measures of probability or of goodness of fit, such as the probable error and chi-square, have serious limitations under such circumstances. The conclusions reached when such measures are relied on may be altogether erroneous. The expansion of the binomial $(p—q)^n$, where $p$ and $q$ are the dominant and recessive fractions whose sum is one, and $n$ is the number involved in the sample, has obvious advantages but is tedious in practice. Dr. B. L. Warwick of the Texas Agricultural Experiment Station has performed a labor of genetic love in working out by this method the probabilities for numbers under fifty and publishing them in a table showing the probability that any given distribution represents chance variation from a ratio of 1:1, 9:7, 2:1, 3:1, 13:3, 7:1, 15:1, 63:1, 265:1. The table should be extremely useful to animal breeders and to anyone studying the genetics of human characteristics. The latter, in these birth controlled days will rarely have opportunity to get beyond the first page. This useful genetic tool is issued as Bulletin No. 463 of the Texas Agricultural Experiment Station, College Station, Texas, and may be obtained by interested parties without charge.

# A Glossary Of Genetic Terms

AGGLUTINOGEN—A substance from which an agglutinin is produced; which, in turn, is a substance which has the property of clumping and precipitating certain specific types of blood corpuscles or bacteria.

ALLELOMORPH—Mendelian characters are inherited in alternative pairs, or in alternative series. These alternative genes are called allelomorphs. Examples: Albinism (recessive), Normal pigmentation (dominant); Horns (recessive), Hornlessness (dominant).

BACK-CROSS—Cross of a hybrid to one of the parental forms.

CHIASMA—"In the diptolene stage (of cell division) the chromatids are associated in pairs in such a way that in one part of their length two chromatids are associated but in another part each is associated with a different chromatid. The point of exchange is termed a chiasma." (Sansome and Phipp, 1932.)

"Exchange of partners between the four chromatids of a bivalent." (L. H. Hill, 1932.)

CHROMATID—Chromosomes frequently bear the foreshadowing of a future longitudinal division so that they appear to be made up of two parallel threads. These threads are the chromatids.

CHROMOSOMES—Tiny dark-staining bodies visible in the nucleus of the cell at the time of cell-division. The number of chromosomes in any species is usually constant. The chromosomes carry the genes, linearly arranged, which control the development of Mendelian characters.

CROSSING OVER—Interchange of segments between two homologous chromosomes previous to the formation of gametes.

CONJUGATION—Side-by-side association of homologous chromosomes previous to formation of gametes.

DIPLOID—Having two sets of chromosomes. Body-tissues of higher plants and animals are ordinarily diploid in chromosome constitution. See *Somatic*.

DOMINANT—A character possessed by one of the parents of a hybrid, which appears in the hybrid to the exclusion of the contrasted character from the other parent (the recessive). Thus in a cross of green- and yellow-seeded peas the first generation has yellow seeds. Yellow is dominant and green is recessive, being transmitted but not appearing in the presence of the factor for yellow.

FACTOR—Same as *Gene*.

$F_1$—(Pronounced eff-one). The first filial generation. The offspring of a given mating.

$F_2$—The second filial generation. Produced by intercrossing or self-fertilizing the $F_1$. The inbred grandchildren of a given mating.

GAMETE—A reproductive cell of either sex; e. g. sperm or ovum.

GENE—(1) The unit of inheritance, which is transmitted in the germ cells, and which by interaction with the genic and cytoplasmic complex controls the development of a character. The genes are arranged linearly in the chromosomes. (2) "The physical basis of heredity"—or more figuratively, the atom of the genetic molecule.

HAPLOID—Having the reduced number of chromosomes, as in germ cells, as distinguished from the diploid or double number of chromosomes in normal somatic cells.

HETEROZYGOUS—Containing both genes of an allelomorphic pair, or two genes of an allelomorphic series. Heterozygous individuals generally resemble the individuals homozygous for the dominant character, but they transmit the recessive to half their offspring.

HOMOZYGOUS—(1) An organism formed by like germ cells; (2) An organism is said to be homozygous for a given character when all the germ cells transmit identical genes for this character. This is the most frequently used meaning of the term.

LINKAGE—Association of genes in inheritance, due to the fact that they are in the same chromosome.

MUTATION—A sudden variation in an inherited character.

ONTOGENY—The developmental history of an organism, from fertilized egg to adult individual

RECESSIVE—See *Dominant*.

SOMATIC—Referring to body tissues; having two sets of chromosomes, one set normally coming from the female parent and one from the male; as contrasted with germ cells having a single set of chromosomes.

SEGREGATION—Separation of allelomorphic genes at meiosis.

SELFED—Self-pollinated.

TRANSLOCATION—Attachment of a fragment of one chromosome to a non-homologous chromosome, resulting in a new arrangement of genes.

ZYGOTE—An organism produced by the union of two germ cells.

# THE JOURNAL OF HEREDITY AS A SUPPLEMENTARY TEXT

SPECIAL RATES TO CLASSES IN GENETICS OR BIOLOGY

Members engaged in teaching genetics or related subjects are cordially invited to use the JOURNAL as a supplementary text in their classes. The rapid progress of the science, after being so long neglected, is one of the most important and attractive features to place before students. It makes even the latest textbooks not fully up to date, but renders them more interesting as the historical background of the discoveries described in the JOURNAL OF HEREDITY.

Ten or more *student memberships* for one year will be accepted at $2.50 per person. *Student subscriptions* covering the academic year of eight months, in groups of ten or more, are offered at half the annual membership fee—$1.50 each; four months for 75 cents. These special rates to students will be accepted only when applied for by members of the Association, in whose classes the Journals are to be used.

**Special Trial Offer to Members of A. G. A.**

Members engaged in teaching will be supplied free up to twelve copies of two issues for classroom use. Try the JOURNAL for two months at no expense and under no obligation to continue. Issues for this purpose will be sent in bulk to members applying for them.

# *Proceedings of the American Breeders Association*

**Vol. I (1904) to combined Vol. 7 & 8 (1911-12)**

Each volume in original binding of green cloth. Many of the articles are reports of original research made soon after the rediscovery of Mendel's laws. For reference purposes they have a growing historical interest, and the earlier volumes are very hard to obtain. A few complete sets are still available, per set of 7 volumes, $45.00. Separate copies of Volumes 4, 6, and 7-8 also for sale—$5.00 per volume.

**AMERICAN GENETIC ASSOCIATION**

**VICTOR BUILDING** **WASHINGTON, D. C.**